May 1, 1967

2086

direct 5/1 DFS

NOTES file 5/1/67

May 15, 1967

B 7/26

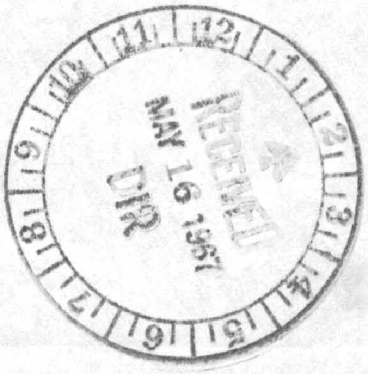
TO: Dr. von Braun

In answer to your question on Nuclear - Thermionics Power Source in my Notes of 5/1, the present yearly funding to GD/GA for this work is about $2.5M ($2.0M from AEC, and $0.5M through LeRC from OART). OART, to our knowledge here, has not yet made a decision to increase funding substantially, allegedly because of "lack of evidence that a requirement for a nuclear-electric space power source in the range of 50 to 100 KWe exists". However, I feel that both AEC and OART would be quite receptive to an indication from MSFC that a requirement of this kind is indeed anticipated not later than 1974 - 76. We are presently preparing a note to OART on this subject, hopefully for your signature.

Ernst Stuhlinger

Ernst Stuhlinger

1 Enc:
Cy of Notes for 5/1



NOTES 5-1-67 Stuhlinger

B 5-1-2

5/19 SB

1. ATM-FILM IRRADIATION: Exposure of ATM film types to protons is scheduled for May 17 and/or 18 at Harvard. The film will be exposed to three energy levels of protons (50 MeV, 90 MeV, 130 MeV) and will be given six different doses at each energy. Low energy exposure (22 MeV and under) is planned for Oak Ridge the first of June.

2. ATM-BALL BROTHERS CONTRACT: The continuation of our contract with Ball Brothers Research Corporation to assist us in our ATM contamination program is to be negotiated Tuesday, May 2. BBRC will assist SSL in laboratory studies and analyses, and P&VE-M in their ATM materials control management function.

3. NUCLEAR-THERMIONICS POWER SOURCE: On April 27, Dr. Robert Pidd of General Atomics presented the status and potential of thermionics for space electric power plants. Representatives of SSL, ME, ASO, and AERO were present from MSFC, and personnel were present from General Dynamics Corporation and General Dynamics/ Convair.

Dr. Pidd indicated that much of the technology is in an advanced state of development. A critical experiment has been initiated under AEC funding and is planned to include successively more sophisticated mockups of the thermionic reactor concept. A reactor program aimed at a ground test in a specific time period has not yet been approved, however. It was estimated that such a program could be carried out for around $5 million yearly for five years, a modest increase over current annual funding.

E.S. How does OART feel about doing this? B

4. SOLAR FLARE PREDICTIONS: Reply to your question 3/8, copy attached. We have not yet been able to obtain a clear answer to this question, but we believe that in case of a very strong flare, the astronauts would be called home as quickly as possible.

Enc 1

NOTES BALCH 5/1/67

S-II-2 Stage - Certificate of Acceptance for second firing on 4/15/67 has been signed. Principally because of power outage at S-II Test Control Center from 4/24/67 to 4/27/67, shipment of stage has been rescheduled from 5/15/67 to 5/20/67.

S-IC-4 Testing - The Boeing S-IC-4 Measurement List for Static Firing and Related Tests has been reviewed and approved. Test stand main derrick motor generator is now scheduled for reinstallation on 5/2/67. Preparations for propellant load test on 5/3/67 and 5/4/67 are on schedule, and static firing is still set for 5/11/67.

S-II A-1 Test Stand - Principally because of power outage at S-II Test Control Center from 4/24/67 to 4/27/67, integrated test of facility and GSE with simulated stage has been rescheduled from 4/26/67 to 5/3/67.

Power Outage at TCC - Approximately one hour after loss of primary power from both high-voltage feeder lines to the S-II Test Control Center on the morning of 4/24/67, emergency power service was on line to provide partial capability and environmental control. Complete service was restored by 2:00 p.m., 4/27/67. Power outage caused slippage of approximately four days in work schedules on S-II test stands A-1 and A-2.

Action to Assess and Minimize Effects of Power Losses - Action has been taken to monitor all critical power busses within the Data Handling Center to determine effects of power fluctuations on all associated equipment.

An investigation has been directed to determine whether effects from power interruptions in the area of the Data Acquisition Facility can be minimized.

Labor Relations - Beginning about 9:00 a.m., 4/26/67, approximately 25 electricians, employed by four electrical subcontractors to Corps of Engineers prime contractors, left their jobs in protest of NASA/MTF's decision to restore a power outage in the S-II Test Control Center with non-craft union forces. All electricians returned to their jobs at the beginning of the first shift the following day, and there was no impact on critical work schedules.

Summary of Claims Resulting from Static Firings - Out of a total of 19 claims, only six have resulted in the filing of formal claims. Two of these six have been denied, one was withdrawn, and three are still being investigated.

NOTES 5/1/67 BELEW

5/1 KS

B 5/2

ATM: We held a meeting with MSC and KSC on April 25 to discuss the proposal to add a three-foot IU section to the ATM launch vehicle. Both MSC and KSC agreed with the proposal. MSC preferred the three-foot approach over raising the LM eight inches. KSC estimated a minor impact of $145K and 10 weeks pad time.

Discussions were recently held with KSC (Jack Smith), Astrionics Lab, concerning KSC's suggestion to meet monthly and discuss ATM requirements at KSC. All participants agreed that an exchange of this type is necessary.

ORBITAL WORKSHOP MOCKUP FOR PDR: The S-IVB Orbital Workshop mock-up arrived at MSFC April 27 and was erected in Building 4619. Final assembly is in process and should be finished by Tuesday morning, May 2, for the Astronaut Walk-Through. Its appearance is excellent. It is factual with few exceptions: enclosed components ceilings, walkways in the common bulkhead crotch, side walls of enclosed compartments, and floor superstructure.

ORBITAL WORKSHOP PDR WALK-THROUGH: The astronauts will begin the walk-through procedure on Tuesday, May 2. Approximately ten astronauts will participate. This activity will proceed through Saturday. Actions from this session will be coordinated by Mr. Pedigo's Crew Station Sub-Board for consideration by the Design Review Board while in session on May 8, 9 and 10.

MULTIPLE DOCKING ADAPTER: The assembly of the Multiple Docking Adapter (MDA) mock-up has begun in Manufacturing Engineering Laboratory. Estimated completion date is May 15. Fabrication of the MSC test hardware (structural test unit) is underway. This article is scheduled for delivery to McDonnell about mid-July. We are identifying with R&DO the Apollo docking hardware required from NAA.

MISSION PLANNING TASK FORCE STEERING COMMITTEE MEETING ON APRIL 25, 1967: The trend appears toward 50° inclination orbit for the second cluster to accommodate meteorological (APP A) and earth resources experiments. Also, Mr. Mathews favors use of single purpose vehicle, i.e., human ferry, unmanned resupply and experiment carriers, to the maximum extent feasible. It appears that the spent stage Workshop could not be launched into this high inclination orbit without the use of solid kick motors on the S-IVB or some other method of uprating the vehicle performance.

During the next month, MSFC will work together with MSC to identify the most attractive mission alternatives. The goal is to select the mission to follow AAP1 through 4 by July, 1967.

LUNAR AAP AD HOC STUDY TEAM: Ten tentative guidelines for the AAP Lunar Program were derived at the third meeting of the AAP Lunar Planning Ad Hoc Committee Meeting on April 27. MSFC has been asked to host the next meeting of this group on May 16 and 17. Items to be discussed are: (1) Saturn V payload capability, (2) MSFC integration effort, (3) MSFC experiments, (4) LSSM, and (5) Lunar Drill Program. It is suggested the appropriate Center participants review with you the status of MSFC's involvement in this activity.

L.B. Please arrange

Notes 5/2

NOTES 5-1-67 BROWN

5/1/67

B 5/2

J-2 ENGINE The second set of S-II-501 simulated tests at AEDC have been rescheduled for tomorrow (5-2-67). This rescheduling was necessitated by the need to change the engine fuel pump and main LOX valve. This engine presently has over 45 starts and there had been a noted drop in pump efficiency during the last several tests; hence, the pump changeout.

A J-2 R&D engine has accumulated over 20,000 seconds in 103 starts without a major component change. This engine will be removed from the test stand this week and disassembled for an electrical inspection. (The J-2 Qual life is 3750 seconds.)

H-1 ENGINE The turbines from engines H-4058 and H-4062 have been disassembled and inspected at Neosho. All components appeared normal. No evidence of foreign objects or material failure was noted. The turbines are being rebuilt for hot test and return to the vehicle. These were the turbines, removed from AS-204, and previously reported as "failure to breakaway at 150 inch-pounds torque" and the other with a "clicking sound" when the turbine was rotated.

The four engines on S-IB-11 (eleven) that had water inadvertently injected into their LOX seal cavities are being vacuum dried and new seals installed to assure proper performance. A study is in progress to determine if any action will be necessary on other stages, when similar water contamination may have occurred.

Shea => I'm in Dallas and Houston this Friday. Please clarify. B

GENERAL In preparation for your meeting this Friday with Dr. Debus relative to Rocketdyne's role at KSC, we are in the middle of coordinating with Saturn IB and Saturn V to insure a unified I.O. position (we hope to have a proposal citing the degree of Rocketdyne participation desired). In addition, Mr. Hirsch is pursuing the contractor involvement of this question in both our MSFC contracts as well as the KSC supplement; and has in fact, already discussed the matter with his counterpart at KSC. It is currently planned to review our proposal and contractual changes required with General O'Connor, Thursday morning (5-4-67).

CONSTAN 5/1/67 NOTES

5/1/67

B 5/2

Visits to Michoud

Mr. J. P. Fields, Director, Program Control Saturn AAP, OMSF, NASA Headquarters, visited MAF on April 24, 1967. He was briefed on organization, operation and contractor relationships by Dr. Constan, Mr. Meldrum, CCSD Program Control, and Mr. Creim, TBC Program Control. He also toured the Boeing and Chrysler manufacturing areas for orientation and familiarization on our manufacturing and assembly capabilities.

On Wednesday, April 25, Mr. Paul Purser, MSC, Dr. Constan, Mr. Wilkinson, Mr. Meldrum and Mr. Balch addressed a meeting of the American Ordnance Association at the Monteleone Hotel in New Orleans. The 90-member group toured Michoud and MTF on Thursday. Michoud was host on April 27 and 28 to MSFC Cost Reduction Symposium.

Computer Operations Office

The Computer Operations Office has established the outline of a plan to recover from the anticipated slippage of installation of Third Generation Computers. This plan was discussed with Mr. C. L. Bradshaw, R-COMP and Mr. Fred Boles, Contracting Officer, on April 26, 1967. The feasibility of the joint Computer Operation Office-Computation Laboratory plan will be explored further at MSFC next week.

Future Events

On May 16, 1967, Dr. George Mueller, OMSF, will visit New Orleans. He is scheduled to give a luncheon address at the Plimsoll Club Internation Trade Mart, to a group of 40 to 45 New Orleans businessmen. In the evening, he will be the principal speaker at the annual dinner meeting of the Greater New Orleans Section, AIAA. This event will be at the Fountainbleau Motel and include AIAA members and wives.

B 5/2

NOTES 5/1/67 FELLOWS

5/19/67

Lockheed/Martin AAP Integration Contract Phase D Proposals:

R&DO was asked about a week ago by the IO AAP Office to review the scopes of work contained in Lockheed and Martin's proposals for the Phase D AAP integration contract. An R&DO position on the integration contract scope of work has to be ready about May 15, because the Source Evaluation Board is proceeding as rapidly as possible with its activities based on the proposals, including the scopes of work submitted by the two companies. The R&DO scope of work can be used by IO in negotiations with the selected contractor.

To clarify the roles of the MSFC participating organizations with the selected integration contractor, we have prepared a "Method of Operation for AAP Integration Support Contract." The proposed method of operation is that IO and R&DO interface with the AAP systems integration contractor in essentially the same manner as is presently done with the Apollo contractors. IO will perform overall project and contract management, and the laboratories will exercise technical direction within the scope of the contract.

NOTES 5/1/67 GEISSLER

5/1/67

B 5/2

1. Elliptical Parking Orbit for Voyager: Recently, DAC proposed that the use of an elliptical parking orbit might provide a substantial payload increase for Voyager. In making the proposal, DAC pointed out that they had not considered launch window availability. However, we know that launch window availability is a very serious consideration. If the elliptical parking orbit is used to gain full payload advantage, the launch window probably disappears completely in most synodic periods. If a third burn of the S-IVB is used, the launch window is available but the payload advantage is lost. Other characteristics of the elliptical parking orbit were considered, e.g. elliptical coast will always be $\approx 360^{\circ}$, while Voyager mission requires coast angles from 0° to 360°. In view of these facts, no real advantages for an elliptical parking orbit for Voyager are evident. An appropriate reply to the DAC proposal is being prepared.

2. S-II Stage Separation: Re: your question on this subject in Notes 3/27/67 Geissler, copy attached. The case given as the worst case condition was #4 engine failing at 2.5 sec. prior to second plane separation. The time frame for this case is about 1.5 to 3.5 sec. prior to second plane separation. Any other times for loss of engine prior to second plane separation does not create a collision problem. The criticality number associated with the worst case engine failure which results in subsequent collision during second plane separation is estimated to be 9.5×10^{-6}. This topic is to be discussed further at the S-II Stage VD&CWG Meeting at S&ID on May 2, 1967. If there is any significant change in feeling conveyed at this meeting you will be notified immediately.

3. Briefing to Institute for Telecommunications Sciences and Aeronomy (ITSA): On April 25, 1967, representatives from ITSA visited us to obtain briefings on a variety of topics. Aero-Astrodynamics Laboratory personnel made presentations on (1) Sound Propagation Studies and Acoustic Wind Profile Measurement System; (2) Ionospheric Disturbance Studies; and (3) SEPTIM (Satellite Ejected Packages for Terrestrial Ionospheric Measurements). Presentations were also made by Research Projects Laboratory personnel on Pegasus (Meteoroid and Earth Albedo) Data, Radiation Studies, and ATM Science. The visitors toured our Atmospheric Research Facility and R.P.L.'s Thermophysics Research Laboratory in the afternoon. Attending from ITSA were Dr. Gordon Little (Director), Dr. Shapley, Dr. Knecht, Dr. Smith, Mr. Pope, and Dr. Kuettner (ESSA). Dr. Little was particularly interested in our acoustic wind measurement and ionospheric disturbance research work, including SEPTIM.

6/19/6

Nothing of significance to report this week.

B 5/2

NOTES 5/1/67 HAEUSSERMANN

1. VISIT WITH Mr. C. Mathews 4/27/67. Subjects reviewed: (a) ATM Star Tracker Procurement and whether the tracker should be mounted on the LM or ATM rack, (b) the ATM digital computer. Mr. Mathews again questioned the need for high pointing accuracy in roll as specified by the ATM Principal Investigators. The roll accuracy required establishes the need for the star tracker. A second function is to keep the cluster principle axis of minimum moment of inertial in the orbital plane.

Conclusions on the tracker were to mount it on the ATM rack (not on the LM). MSFC is not to limit consideration only to the MSC tracker (LORS developed by Hughes) but is to proceed with the current RFQ evaluation. Mr. Mathews wants to be advised of our selection prior to entering a contract.

The MSFC approach to the ATM digital computer is to have a separate computer for the ATM functions (see Notes 4/10/67 Haeussermann). Mr. Mathews' initial reaction was to try to get by without a digital system. He later recognized that we have a computational need but that more use should be made of the astronaut for some of the timing functions. No conclusions were made on the subject of which computer to use. Further discussions will be held with Mr. Mathews after he has studied detailed information which we left with him.

NOTES 5/1/67 HEIMBURG

5/1967 B 5/2

S-IB

A propellant load test was successfully performed on stage S-IB-10 on April 28, 1967. The schedule for the short duration test is now May 9, 1967. ✓

F-1

The spare flight engine S/N F-6049 was removed from the test stand on April 28, 1967, and returned to Quality Laboratory. Engine S/N F-5038 was re-installed for a series of tests to further evaluate the thrust vector control system and cutoff characteristic during lox depletion. ✓

MODERATE DEPTH LUNAR DRILL PROJECT

Request for Quotations for the second phase effort of the Moderate Depth Lunar Drill have been delivered to the various contractors for review and proposal. ✓

S-IC (MTF)

The S-IC-4 stage propellant load test is scheduled for May 3 and 4, 1967. ✓

S-IC-S PRESSURE TEST PROGRAM (MSFC)

The tests performed on the S-IC-S fuel tank were completed on April 28, 1967. The suction duct structural test was completed on April 27, 1967, and the tank hydrostatic test at ultimate pressure (44.1 p.s.i.g. upper bulkhead) was conducted the following day. A small weld crack occurred in the apex of the aft bulkhead at the above stated pressure.

S-IVB (SACTO)

The attempted acceptance firing of S-IVB-503 (New) was scrubbed on April 26, 1967, during stage LH_2 tanking due to erratic indications from the LH_2 PU probe. When the probe was checked, a plastic cap was found to have been left off the pin which locks the joint of the probe together, allowing the locking pin to come loose causing an electrical short between the core and the outer shell when the probe was subjected to cryogenics. The entire probe will be replaced.

K.H. Please ask I.O. to tell Douglas that we expect them to tighten up their procedures B

The 90% Design Review on the Beta III test stand rebuild was held at the Sacramento Test Center on April 27, 1967. DAC was informed that the MSFC Test Laboratory wanted all critical equipment on the test stand moved and protected behind concrete, if possible. DAC apparently does not approve of this approach and will make a presentation on this subject on May 10, 1967, to Test Laboratory personnel at MSFC. ✓

S-II STAGE (MTF)

The A-1 Test Stand simulated wet countdown test scheduled for April 26, 1967, and post-static checkout scheduled for S-II-2 was temporarily halted this week due to A.C. power failure. Post-static checkout of S-II-2 was resumed after it was determined that no harm had come to the stage because of this power failure. The wet countdown test on A-1 has been re-scheduled for May 4, 1967. ✓

S-II STRUCTURAL TEST PROGRAM

Approval was given on April 27, 1967, for construction of Phase I, Additions to Cryogenic Storage. Design is approximately 90 percent completed for this phase and about 35 percent completed for Phases II and III. ✓

K.H. Request a joint briefing by Test and P&VE on this SII structural test program. Please arrange. 1 hr. or so. B

B 5/2

NOTES 5-1-67 HOELZER

5/1967

1. MANAGEMENT INFORMATION SYSTEM: A computer system proposal developed by Computation Laboratory in conjunction with Manufacturing Engineering Laboratory on a Management Information System has recently been approved for development by Manufacturing Engineering Laboratory. This will be an integrated data processing system designed to allow management by exception to provide a tool for decision making on both short and long term objectives. The equipment to be utilized in this system is the UNIVAC 1108 computer which will be used to store and process related data elements pertinent to manufacturing engineering. ✓

2. AAP DATA HANDLING STUDIES: Computation Laboratory personnel participated (April 19-21) in a source evaluation for a study contract ERC is letting for a study of archival data storage requirements under AAP. This study is closely related to an OMSF study being performed "in-house" by Computation Laboratory. The Comp Study is to recommend a "Post Flight Data Flow Plan for AAP" and will be used by OMSF to formulate their final plans. In general, the Comp Study indicates that there are sufficient planning mechanisms existing within OMSF to allow the centers to handle post flight AAP data in their normal course of business. ✓

NOTES 5/1/67 JOHNSON

5/1/67

B 5/2

Negative report.

NOTES 5-1-67 KUERS

B 5/2

5/19 B

S-II Weld Offsets: An in-house program had been established in the ME Laboratory for determination of causes for offsets in horizontal girth welds. Several 11 foot diameter cylinders have been fully instrumented for measurements of temperature distribution in upper and lower cylinders and for measurements of expansion and relative movements of the cylinders during the welding process. Two main factors causing weld offsets have been determined: (1) Unsymmetrical design of weld joints creating unsymmetrical temperature distribution (isotherms) of upper and lower cylinders and (2) residual stresses in areas of vertical weld seams or gore segments. Both factors create local offsets during welding even with perfect alignment prior to welding. This explains the high incidence of weld offsets in the LH_2 dome to cylinder #6 weld: a dome with built-in stresses in formed and welded thin gore segments and an unsymmetrical large heat sink in cylinder #6 (bolting ring). If we do not want to take the chance of having offsets in this weld again in the next stage, S-II-7, we should decide now on one of the following three possible changes: (1) Change the design of this weld joint to a more symmetrical configuration or (2) change the weld technique using a conventional rigid tooling concept, the cost of which and time for development would be prohibitive, or (3) change the weld process to the opposed nugget pulsed arc process. The last solution appears to have minimum program impact. Unfortunately, there is no other repair technique available for correcting existing offsets than cutting off the entire joint and rewelding it which is certainly not very desirable. A decision for the next weld for S-II-7 in one way or another must be made soon.

noted 5/2

I.O.

Suggest a systematic review of all this, in particular the question of whether or not we are ready to switch to pulse-arc welding, before we use up valuable SII-7 hardware. We have so much schedule lead with Sat V now that it would be foolish to settle for anything but the best available solution. Please get Lucas and Gray's views also, before we finalize decision.

B

NOTES 5-1-67 LUCAS

1. ORBITAL WORKSHOP: Preparations for the Orbital Workshop Preliminary Design Review (PDR) are proceeding on schedule. May 3, 4, and 5 - Astronaut walk-thru. May 8, 9, and 10 - Formal PDR. The Workshop mockup arrived by Guppy the morning of April 27 and was set up at the P&VE test complex, building 4619. Design engineers, crew systems engineers, principal investigators representatives, and astronauts will conduct a complete evaluation of the mockup hardware prior to the PDR.

2. J-2 ENGINE: Rocketdyne was requested to remove the cover from the J-2 Engine electrical control assembly (ECA) on 15 J-2 Engines and inspect for contamination. As of April 18, 1967, 14 J-2 Engine ECA's had been inspected, 10 of the 14 units contained contamination in the form of solder splatter, solder balls, metal shavings, wire whiskers from the internal shock mounts, brush bristle, and scraps of safety wire. Five of the units had contamination of a size to be a potential problem. Due to the high percentage of contamination found in the ECA's, additional inspection will be performed on two units. Final disposition on the units inspected and the remaining units in the field has not been made.

3. 501 DAMPER: Hydraulic fluid was inadvertently pumped through the pneumatic system at KSC. We have sent design and test engineers to KSC to assess the impact. Boeing replaced 2 pneumatic cyliners, 2 flow control valves and completely disassembled the pneumatic system. Now, the system leaks. Our critical control valve settings have been lost, and the whole system must be recalibrated. In the meantime, the ML-2 primary damper and redundant hoist system are being tested and should be ready for shipment to KSC by approximately June 16, 3 weeks prior to rollout. We are recommending the use of the ML-2 for 501 launch and return the ML-1 to MSFC for retesting. We are working the schedule problem with IO.

4. ACCIDENTS AT S&ID ON APRIL 25, 1967: S-II-503 in the vertical station #8 was damaged when a walkway which was not properly secured fell on the LH_2 bulkhead. A gash about 8 inches x 21 inches resulted in the 1/2-inch thick helium-purged insulation. S-II-506 was also damaged when scaffolding being removed from the LH_2 tank was dropped on the common bulkhead. There is already a bonded patch on the common bulkhead as a result of a pair of pliers being dropped earlier in assembly. It is possible that additional bonded patches will be proposed by S&ID to correct the dents from the dropped platform.

5. CONTAMINATION IN S-II LOX TANKS: S&ID has reported that contaminated rivet heads, resulting from improper cleaning of manufacturing tools, were found in S-II-503, -504, and -505. The rivets are used in the LOX baffles. S&ID has not yet indicated a position relative to inspecting S-II-501 and -502 although the problem was considered serious enough to begin removal of the contamination in stage 503 through 505.

6. S-II SPRAY FOAM INSULATION TESTS: Plans are being made to spray-foam insulate (CPR-369-3 material) an 8-foot diameter x 20-foot long tank that has been found at DAC. S&ID will refurbish and insulate the tank, and DAC will do the LH_2 testing. With this tank, it will be possible to duplicate the calculated strains in the tank wall that are encountered during S-II flight. At present, we see no opportunity to simulate aerodynamic heating simultaneously; but the large scale tank test should significantly improve our confidence in the survivability of the spray foam insulation. Schedules are being developed, but it is hoped that the testing can be completed prior to spray-foaming the sidewalls of S-II-508.

NOTES/MAUS 5/1/67 B 5/2

5/1 B

ON-LINE INFORMATION RETRIEVAL AND REPORTING SYSTEM - The MSF/MSFC Data Link, which was discussed in an earlier note, is now being expanded by Apollo Program Control to include KSC and later MSC. In addition, a general retrieval program, capable of handling many different data files, is under development. Our objectives in this area, in addition to remaining knowledgeable of Headquarters developments and trends, are to extend the knowledge and capability of on-line information systems and to promote a better understanding within Marshall of their potential.

The Data Link, as well as your Management Schedule Display System, are pilot systems leading toward an integrated on-line information retrieval and reporting system which could economically and practically fulfill the information needs of the Center and fully utilize the Third Generation computing system capabilities. We would like to demonstrate our present system and discuss this effort in more detail at your convenience. → H.M. Please arrange B

noted, BK 5/2

RATIONALIZATION FOR A LOW-COST SATURN IB - We have proposed to Col. Teir a rationale for a lower-cost Saturn IB. In summary, our proposal is to determine the cost of producing 4 Saturn V's per year (no Saturn IB's), then determine the cost of producing, concurrently, 4 Saturn V's and 4 Saturn IB's per year. The true cost of the Saturn IB is the increase in the cost of concurrent production over the cost of Saturn V production alone. ✓

We tested this theory with the Apollo Cost Study computer program and developed the following results:

Cost of producing 10 Saturn V's only (516-525) at a 4 per year rate	$1609.0 M
Cost of producing 10 Saturn V's and 16 Saturn IB's (213-228) at a 4x4 yearly rate	$2066.2 M
	$ 457.2 M

This shows an average unit cost for Saturn IB of $28.5 M. ✓ Our present projections for these same Saturn IB vehicles result in an average unit cost of $32.2 M.

This proposal is currently being studied in IO.

I believe this logic is analogous to the OSSA position used to continue to produce the Atlas/Centaur combination. ✓

B 5/2

NOTES 5/1/67 RICHARD

5/1/67

No submission today.

NOTES 5/1/67 RUDOLPH

5/1967

B 5/2

1. AS-501 Launch Vehicle at KSC:

   o Schedule Changes:

   - Due to spacecraft (CSM 017) problems, the launch of AS-501 has been rescheduled by MSF to the latter part of the summer.

   - Spacecraft erection is now tentatively scheduled for Saturday, 20 May 67, and rollout is expected about Friday, 7 July 67.

   - My Pre-Flight Review (and pre-rollout review) has not been changed and is still scheduled for Wednesday thru Friday, 17-19 May 67, as I want to expose all potential problems as early as practicable.

A.R., In Huntsville? Please send me agenda for all 3 days B

   o MSF has approved the use of a yaw bias in the AS-501 launch in order to protect the launch facilities.

   o We have been informed by Lee James (at MSF) that Boilerplate 30 spacecraft will not be used on the AS-501 vehicle; however, MSFC is to continue work on the spacecraft as it may be used on another early Saturn V launch. Teletype confirmation is to follow.

   o Arrangements are being made to have contractor - MSFC-KSC teams of design and quality personnel inspect all cables and wiring in accessible areas on the AS-501 stages for breaks, twisting, rubbing, damage, etc.

2. S-II-2 Stage at MTF:

   o Due to failure in facility power supply, post firing checkout of S-II-2 stage was delayed about six days. Stage will now be on-dock KSC, Thursday, 25 May 67, in lieu of Friday, 19 May 67.

3. Astronaut Briefing at MSFC:

   o Fourteen astronauts were briefed on Thursday and Friday, 27-28 April 67, on the Saturn V systems performance.

4. S-IVB-503 (new) Stage at SACTO:

   o Acceptance test, which was scheduled for Wednesday, 26 April 67, was scrubbed due to erratic operation of the propellant utilization system. Test is now scheduled for Wednesday, 3 May 67.

NOTES 5/1/67 SPEER

5/1/67

B 5/2

1. OPERATIONS RETREAT MEETING: Stevenson's Operations Retreat scheduled for last week-end has been postponed and no firm reschedule date is known. Main reason was non-availability of KSC participants.

2. REAL TIME ANEMOMETER DATA: After extended negotiations KSC has recently accepted the MSFC requirement for real time pad anemometer data in support of launch wind evaluation. However, an estimated five to eight months will be required to implement the capability.

3. MCC-H AUGMENTATION FOR AAP: MSC presented a MCC-H Augmentation Plan for AAP to Gen. Stevenson and Bellcomm on 4/21. MSFC was not invited to attend. The plan basically calls for approximately doubling the capabilities of MCC-H (number of control rooms, computers, amount of simulation equipment, etc). MSC estimated the approximate cost at 50 M$ over a three year period. There were, however, some indications that the computer requirements could be cut significantly by work sharing between MCC-H and the MSC Computation and Analysis Division. No decision was made.

NOTES 5-1-67 Stuhlinger

5/1/67

B 5-1/2

1. ATM-FILM IRRADIATION: Exposure of ATM film types to protons is scheduled for May 17 and/or 18 at Harvard. The film will be exposed to three energy levels of protons (50 MeV, 90 MeV, 130 MeV) and will be given six different doses at each energy. Low energy exposure (22 MeV and under) is planned for Oak Ridge the first of June.

2. ATM-BALL BROTHERS CONTRACT: The continuation of our contract with Ball Brothers Research Corporation to assist us in our ATM contamination program is to be negotiated Tuesday, May 2. BBRC will assist SSL in laboratory studies and analyses, and P&VE-M in their ATM materials control management function.

3. NUCLEAR-THERMIONICS POWER SOURCE: On April 27, Dr. Robert Pidd of General Atomics presented the status and potential of thermionics for space electric power plants. Representatives of SSL, ME, ASO, and AERO were present from MSFC, and personnel were present from General Dynamics Corporation and General Dynamics/ Convair.

Dr. Pidd indicated that much of the technology is in an advanced state of development. A critical experiment has been initiated under AEC funding and is planned to include successively more sophisticated mockups of the thermionic reactor concept. A reactor program aimed at a ground test in a specific time period has not yet been approved, however. It was estimated that such a program could be carried out for around $5 million yearly for five years, a modest increase over current annual funding.

E.S. How does OART feel about doing this? B

4. SOLAR FLARE PREDICTIONS: Reply to your question 3/8, copy attached. We have not yet been able to obtain a clear answer to this question, but we believe that in case of a very strong flare, the astronauts would be called home as quickly as possible.

NOTES 5/1/67 TEIR

5/1 B

B 5/2

LC-37B UPDATE FOR AS-204 MISSION: In reference to your question on my 4/17/67 notes (copy attached), concerning G. E. overtime, there is no basic problem here; it is exactly the opposite of that. The task of reconfiguring LC-37B for SA-204 instead of SA-206 for the LM-1 mission was the pacing item and required good management and expedited mod kit preparation. Our estimate of this update requiring unlimited overtime was based on past G. E. experience. Not only was G. E. 's performance excellent in accomplishing this effort but also the spirit and enthusiasm of the personnel in the conduct of the effort was very pleasing. I have conveyed my congratulations to Mr. Keister of G. E. by letter for the splendid effort by the G. E. company in connection with the reconversion of LC-37B for SA-204/LM-1.

IBM, HUNTSVILLE: I have been informed that IBM, Huntsville, has about 100 direct people on contracts other than our mission contract. Their salesmanship efforts are starting to bear fruit and I anticipate that this number will go even higher.

PROPELLANT DUMP EXPERIMENT ON S-IVB-204: In reference to your question on my 3/27/67 notes (copy attached), concerning obtaining Headquarters approval for S-IVB passivation experiment, General Phillips' approval was received the week of 4/10/67. This approval was granted as a result of a Saturn V Program requirement for this experiment based on the following factors: S-IVB propellant management schemes have not been fully developed for alternate missions, orbital coast periods, and trans-lunar coast periods (before and after spacecraft separation; the Apollo Program requirement to utilize main propulsion system venting to minimize the probability of S-IVB and spacecraft recontact during the mission and to minimize the probability of S-IVB impact on the moon could require dumping of the S-IVB stage propellant residuals. Specifically, the primary items to be determined by this experiment that cannot be obtained through analytical methods are: launch vehicle orbital controllability with the auxiliary J-2 engine gimbal system in conjunction with the S-IVB APS during the propellant dump period, and the quantity/rates of propellants that can be dumped through the J-2 engine and the resulting velocity changes.

Although this experiment was justified for the Saturn V mission, it provides the data required for LH_2 tank passivation for the S-IVB workshop.

May 8, 1967

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MSFC ROUTING SLIP

	CODE	NAME	INIT.	ACTION	INFORMATION
1	DIR	Dr. von Braun ✓			
2					
3		B 6/14			
4					

NOTES file of 5/8/67.

REMARKS

Reference your comments on Dr. Lucas' Notes of 5/8/67, we met with MSC on May 16, 1967 and agreed upon a payload module control weight. On that date MSC accepted our proposal to use the ATM type design for the LM&SS Rack. The re-design of the Rack is on schedule and we have had several interface meetings with the payload module contractors and with MSC to define interfaces for the new configuration. Final drawings will be released as of June 19th and a rerun of the payload module access review will be conducted in November.

Stan Reinartz
Lee Belew

cc:
R-P&VE-DIR, Dr. Lucas
I-S/AA-MGR, Mr. Reinartz

RECEIVED JUN 9 1967 DIR

CODE	NAME	DATE
I-S/AA-MGR	Leland F. Belew	6-7-67

MSFC - Form 183 (Rev. February 1961)

NOTES 5-8-67 LUCAS

1. ELECTRICAL CONTROL ASSEMBLY (ECA) INSPECTION STATUS (REFERENCE NOTES 5-1-67): A decision was made in a meeting with Dr. Rees, with representatives from R&DO, IO Stage and Engine Office, and Rocketdyne that the ECA's on S-II/501 would not be inspected. With the exception of S-II/501, all other ECA's (S-IVB/501) will be inspected.

2. SATURN V DAMPER (REFERENCE NOTES 5-1-67): KSC authorized the disassembly. After the system was erroneously contaminated, it had to be disassembled and cleaned. After delivery to the Cape, KSC is responsible for check-out and operation. Since MSFC developed the system, we believe we will be held responsible for proper functioning, and to avoid similar occurrences in the future, we have requested that no changes to the system be made at KSC without prior approval of MSFC design personnel.

3. S-II WELDING: (REFERENCE YOUR COMMENT ON GRAU NOTES 4-24-67): This laboratory has been evaluating the pulse-arc MIG welding process developed by R-ME. Current S&TD practice is to use TIG welding. Standard MIG welds of 2014-T6 are known to result in less ductile joints at cryogenic temperature than TIG welds, and there are strong indications that the fracture toughness of standard MIG welds in 2014-T6 is inferior at all temperatures to that obtained with TIG welding. Therefore, we believe it essential to assure that the pulse-arc MIG welds are at least equivalent to TIG welds used currently on the S-II stage with respect to fracture toughness before we recommend such a change since the S-II design was based on TIG weld properties. We believe that this is especially important in view of the Silverstein report which, as you know, questions the fracture toughness at cryogenic temperature of the best welds in S-II. It is estimated that our qualification program can be completed in 6-8 weeks.

4. S-IVB ASTRONAUT WALKTHROUGH: The Astronaut Walkthrough was finished on schedule (May 5, 1967). After completing and reviewing, the comments of the crew and other participants of the exercise were reduced to a total of 68 particular sets of comments. Most of the comments were the result of not having valid representations of the corollary experiments. This is going to require some rerun of the walkthrough (some of the principal investigators have not received funding approval yet), with possible rearrangement of the floor plan to better accommodate these experiments. The other principal areas of comment were mobility aids, sharp protrusions, electrical cables, fans, and penetration sealing devices. Some strong opinions for the need of neutral buoyancy testing were voiced. It is also evident that continued updating of the S-IVB Crew Quarters Mockup will be necessary. It is apparent that all electrical wires in the Workshop must be routed in electrically insulated conduits.

5. PAYLOAD MODULE (PM)/RACK: We decided to abandon the present PM/RACK design in favor of a modified ATM RACK design because of: (1) Complexity of design of the corner and SLA attach point fittings of the 30M12640 (present PM/RACK) design, and (2) excessive lead time required to produce the first article. Advantages of the modified ATM RACK design are: (1) Simplified design (upper, lower, and SLA attach point fittings), (2) Improved delivery schedule, (3) Greater PM accessibility, (4) Capable of meeting further PM contingencies by: (a) Allowing for PM weight increase to 6250 pounds or more, (b) Permits addition of ballast required for AS-504-C capability, (c) Provides less severe dynamics environment, (d) Provides capability of extended length PM with retained SM engine bell clearance. A disadvantage is the possible weight increase of the RACK, an estimated 400 pounds. MSC continues to change the RACK/PM requirements, each month bringing significant weight changes. MSC is unwilling, or unable, or both, to provide program definition of sufficient clarity to permit firm decisions to be made.

5/8/67

NOTES 5/8/67 BALCH

B 5/16

S-II-2 Stage - Shipment of stage to KSC is still scheduled for 5/20/67, with removal from stand to begin on 5/15/67. ✓

S-IC-4 Testing - Test stand main derrick motor generator was reinstalled on 5/2/67 as scheduled, and the derrick was subsequently checked out and proof-loaded. Propellant load test was successfully completed on 5/5/67, and static firing is still scheduled for 5/11/67. ✓

S-II A-1 Test Stand - Principally because of the S-IC-4 testing, the integrated test of facility and GSE with simulated stage has been rescheduled to start on 5/15/67. Approximately 300 open items on the facility remain to be worked off. However, only twelve of these would constrain a static firing. A consolidated list of all open items has recently been furnished the Corps of Engineers. ✓

Survey of Moisant Airport Operations - At the request of the Director of Transportation and Logistics, NASA Headquarters, traffic and packaging personnel from MTF and MAF will participate in a survey of the cargo terminal operations at Moisant Airport today. Intent of survey is to promote damage-free delivery of Government shipments of critical, high-value, and mission-related cargoes. ✓

MTF Open House - Preparation are underway for "Open House" at MTF scheduled for the weekend of 5/13/67 and 5/14/67. A number of exhibits have been made available for this event, and a large attendance is expected. ✓

Investigation of Effects of Power Interruptions on S-IC Power and Control Systems - With reference to your question on my "NOTES" dated 4/24/67, the possible irregularities in power and control systems to be investigated included those affecting the test stand, the stage, and the GSE. Incidentally, this investigation is still under way, and the results are not yet available. ✓

NOTES 5/8/67 BELEW 5/8/15 B 5/16

MISSION REQUIREMENTS PANEL: The first meeting of the Mission Requirements Panel was held at MSC on May 1 and 2. We agreed on the list of some 12 action items which were assigned to the various sub-panels.

INSTRUMENT UNIT MODIFICATION TO SUPPORT SYNCHRONOUS ORBIT: A request for information on Instrument Unit mods necessary to support the S-IVB 3-burn synchronous orbit mission has been forwarded to I-V, along with a recommended statement of work. This request asks for schedule and cost, as well as requirements for software and hardware changes. The information is expected by July 1, 1967.

ATM: As a result of meetings held last week concerning AAP-3 and 4 weights and performance, it was decided to proceed with the ATM Rack design to support a 10,500 pound LM (Lunar Module). It appears that this will cause a Rack weight increase of about 300 to 500 pounds.

On May 3 we negotiated with Ball Brothers Research Corporation (BBRC) a contract for thermal and contamination studies. The effort is to cover a period of 90 days and the cost will approach $300,000.

Space Science Laboratory personnel are heavily engaged in determining the effects of radiation on the ATM films. Cobalt 60 radiation tests have been performed at this Center; however, a good correlation between cobalt and protons is still not known. Plans are to perform proton accelerator tests at Harvard during this month. These tests are being conducted through Langley because Harvard is under contract to them to do work in this area.

LUNAR MAPPING AND SURVEY SYSTEM RACK: Based on further analysis of the current Rack's capability to meet flight and schedule requirements resulting from recent LM&SS Payload Module weight increases, MSC has been informed that a Rack design is being initiated to accommodate these PM weight increases and meet later (September, 1967 vs March, 1968) delivery requirements.

MISSION OPERATIONS: A meeting was held with Mission Operations on May 5 to brief ATM Project and Orbital Workshop Project representatives on the present plan for utilizing MSFC capabilities to back up MSC Flight Operations a real-time basis. At the same time we will start working to identify available hardware and software that can be utilized at MSFC during real-time support.

MULTIPLE DOCKING ADAPTER: We received a letter from Mr. Kenneth Hecht (MSC) requesting sign-off on the McDonnell Company-prepared MDA/AM interface document. But we have returned the sign-off sheet unsigned and recommended strong support of panel action by both Centers to accomplish and document the interface.

PAYLOAD INCREASE STUDY FOR AAP-2 & 4: Saturn IB Office is preparing a scope of work to Douglas Aircraft Company (DAC) to furnish by May 18 an impact on S-IVB Stage of equipping aft skirt with solid propellant motors to obtain apogee kick for AAP-2 and 4 to circularize orbits, allowing payload increase. Also, DAC is to furnish study on maximum impulse available with S-IVB restart.

Studies on SLA-Nose Cap jettison are to be furnished by P&VE, and studies on four-minute man strap-ons for the S-IB Stage are to be furnished by R-AS by May 18, 1967.

NOTES 5-8-67 BROWN

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F-1 ENGINE As reported in prior notes to you, two primary LOX seal mating ring failures have been experienced on R&D engines. These failures which were detected by an increase of pressure in the seal vent cavity, did not result in an engine failure and did not affect engine performance. Subsequent investigations have revealed that excessive heating and subsequent mating ring cracks are caused by the use of abnormal carbon material in the seal. Six out of 16 seals containing carbon from this abnormal lot were found to have excessive static leakage. Analysis of records indicate that one lot of carbon having characteristics unlike all previously evaluated samples were received from the supplier, Pure Carbon Company. Flight engines containing seals made from this lot of carbon consists of two engines on vehicles S-IC-5 and S-IC-6. The risk of retaining these seals in deliverable engines is presently being weighed against the impact of replacing the seals. Replacement at this time would not create the schedule impact that could result from excessive leakage discovered immediately prior to static testing or launch. ✓

C-1 ENGINE The action to phase out the C-1 this fiscal year was initiated with Reaction Motors Division, April 26. RMD has already taken action to implement the qualification of a limited version of the C-1 by June 30. ✓

H-1 ENGINE As reported last week, traces of water were discovered during the normal swab checks of four engines on S-IB-11 (eleven). It was decided to place a vacuum purge on the system to remove all remaining water and then to replace the main LOX seals. During the vacuum purge process, liquid was obtained from all four engines. On subsequent removal of the LOX seal, a white crystalline compound was found in all the LOX cavity areas. Analysis of this compound showed that it was apparently normal oxidation products of the 1050 aluminum gearcase casting. The engine which showed the most severe oxidation in this area is being removed and returned to Rocketdyne for analysis and subsequent use as a basis for recommended actions since there are several other engines which may have been contaminated by the leak test fluid. A complete study is in progress by Rocketdyne, CCSD and MSFC laboratories to determine the total number of engines affected and the fluid corrective action which will be necessary. ✓

J-2 ENGINE A sample inspection of 14 ECA's revealed that contamination in the form of safety wire and steel wool was present in some of the packages. As a result of this inspection Rocketdyne has recommended that all ECA's be removed from J-2 engines and returned to Canoga Park for disassembly and cleaning. An Engine Field Inspection Request has been issued to remove all ECA's from all J-2 engines with the exception of S-II-501 and 502. Turn around inspection time on the ECA is one week with six ECA's a week running in parallel.

BB → How about these ? B

The S-II simulation tests at AEDC were canceled last week due to facility problems. The facility conditioning equipment experienced several valve failures in the helium and nitrogen systems. The tests have been rescheduled for tomorrow (5-9-67). ✓

NOTES 5/8/67 CONSTAN

VISIT TO MAF

Mr. Lou Lyon, Director-Dallas Region, U. S. Civil Service Commission, Dr. Richard Wells, in charge of Graduate School, University of Oklahoma, and Mr. Wayne Jett, Director, Advance Training Program, University of Oklahoma, visited the Michoud Assembly Facility on Wednesday, May 3, for general briefing and tour. They were accompanied by Mr. Arthur Sanderson and Mr. N. L. Houchberger, Personnel Office, MSFC.

NOTES 5/8/67 FELLOWS

5/8/67

B 5/16

1. The Mechanization of Contractor Financial Reporting: On Friday, May 5, a major step was taken toward realization of mechanizing the single support contractor's financial reporting. Detailed explanations were given to the contractors' representatives as to exactly what is expected of them in responding to an RFQ issued by the Purchasing Office to obtain monthly financial data in a form suitable for processing on Marshall computers using Computation Laboratory developed computer programs. Following the MSFC briefing to the contractors, representatives of the Financial Management Office, the Purchasing Office, Operations Management, and Computation Laboratory answered all questions posed by the contractors and satisfied all queries to the extent that their responses to the RFQ, due May 15, 1967, should be reasonably complete and to the point. ✓

2. Prelaunch Test and Checkout Documentation: To find ways and means to improve the quality of the Prelaunch Test and Checkout Documents and to reduce the number of days and the man-hours required for laboratory review of these documents, a series of meetings has been held between IO and R&DO. Last week, Mr. Weidner and Mr. Hueter were jointly briefed by IO and R&DO representatives on the status and quality of these documents and the required reviews by MSFC of KSC generated documents. They furnished guidelines to both Operations to clarify the baselining of these documents; improve the revision process; and review administrative machinery so that our prelaunch test and checkout documentation will continue to provide timely and technically accurate support to KSC for vehicle launches. Follow-on meetings at the working level have translated those policies into operational guidelines which should accomplish the established objectives. These guidelines will be submitted to IO and R&DO management for approval. ✓✓

NOTES 5/8/67 GEISSLER B 5/16

1. AS-503 LH_2 Continuous Venting During Post-Injection Coast Period: Re: your questions on Notes 4/24/67 Geissler, copy attached. At the 20th Flight Mechanics Panel Meeting on April 19-20, 1967, it was agreed that the AS-503 mission planning would proceed on the basis of utilizing continuous propulsive LH_2 venting during the post-injection coast period including spacecraft separation, docking and LM extraction. In regard to your question about the hazard imposed by firing spacecraft RCS while venting LH_2, we expect no danger from combustion of gaseous H_2 at altitudes $\geq$ 50 km. The low density depresses the reaction rates to very low values. Only mixtures of condensed H_2 and O_2 can be dangerous, potentially acting as explosives. No accumulation of such solids is expected at the vent. ✓

2. Crossed-Beam Technology: During the week of April 17, Dr. F. R. Krause presented a paper on X-beam wind and atmospheric turbulence measurements to the American Geophysical Union at Washington, D.C. Simultaneously, he and Mr. C. G. Miles, R-EO-R, visited several NASA Hq. offices to discuss X-beam programs. (a) An ERC-proposed joint ERC-MSFC program for systematic airplane-borne CAT (clear air turbulence) measurements was discussed with OART. MSFC would provide instruments and computer services; ERC would furnish airplane and manpower. (b) OSSA was briefed on meteorological X-beam monitoring systems. They agreed to study the concepts in more detail, and to advise us on the development of infrared scanning systems. (c) Airplane and spacecraft borne X-beam flight test programs were extensively discussed with OMSF. The OMSF representatives showed great interest and suggested a future presentation to Hq. people active in remote sensing. Mr. George, OMSF, will explore joint program sponsorship between OMSF and ultimate users, like OSSA. (d) Dr. Nordberg, GSFC, was given a briefing at his request. GSFC offered to assist us with in-house pilot experiments on X-beam spectroscopy, spectroscopic data, and consultation on hardware. (e) Mr. Harper, Director of OART's Aeronautics Division, endorsed X-beam activities and wants to call the attention of the OART centers to its wind tunnel applications. A more detailed trip report (R-AERO-A-67-9, April 26, 1967) is in your file. ✓

3. Solar Prominences and Flares: Astrionics Laboratory recently requested a presentation on "Solar Prominences and Flares" to aid their planning of solar observations for ATM. On April 26, Mr. G. Daniels made such a presentation to 35 people from Astrionics and several from P&VE. Movies of solar flares taken at Sacramento Peak were shown. Considerable interest was evident, and P&VE requested a similar presentation. ✓

4. Lunar Orbital Surveyor and Mobility Mode Exhibit: Per your request, we have assembled a "Lunar Orbital Surveyor and Mobility Mode Exhibit" and have put it in west end of lobby in 4200. ASO and Graphic Engineering Branch assisted in preparations. ✓

NOTES 5-8-67 GRAU

5/8/67

B 5/16

1. MANNED FLIGHT AWARENESS: This Laboratory is providing support to the Manned Flight Awareness Office in the current Contractor/MSFC program of awareness meetings with all suppliers of critical Saturn/Apollo hardware. The Laboratory Special Assistant for Quality Assurance has been temporarily assigned to the Manned Flight Awareness Office to serve as the MSFC focal point for this effort. Other Laboratory personnel are providing additional support in making arrangements for DOD personnel to attend awareness meetings, and in developing detailed status and other information used in carrying out the program. ✓

2. AS 501 AND 204: KSC has been requested and agreed to form contractor/government teams to reinspect the wiring and cabling in AS 501 and 204. This will be accomplished in parallel with other work from May 9 to May 16. ✓

3. INSTRUMENT UNITS: The review of the wiring and cabling of all available instrument units which Mr. George White, MAR, is asking for will be performed by a MAR/MSFC/KSC team later this month. Agreement was reached that the findings for the instrument units of AS 501 and 204 (see above paragraph) will be made available to this team and accepted by it thus eliminating duplication. ✓

NOTES 5/8/67 HAEUSSERMANN

5/8/67

B-5/16

1. Termination of the Cryogenic Gyro Development. After over eight years of R&D work at GE on the Cryogenic Gyro, the contract will be terminated. Very valuable experience in the field of superconductivity and cryogenics has been obtained and gyro drift constancy during 30 hour intervals of 0.001°/hr. or better about each of the two reference axes has been obtained. Despite these good results, a very extensive and expensive development program over many years would become necessary to generate flight worthy inertial sensors as gyros and accelerometers which, as we foresee, would be very complex. Thus, in agreement with OART, I decided to discontinue this project; an additional aspect has been that no good justification exists for a gyroscope with a drift rate about one to two orders of magnitude better than those presently available. ✓

2. ATM Principal Investigators Conference. The next ATM Principal Investigators Conference is currently scheduled for June 1 and 2 in Washington, D.C. and will include a four part presentation on June 1 to be delivered by ATM elements within MSFC. Presentations will be made on pointing control system, the closed loop TV display system, passive thermal control system status and a general discussion on Manned Space Flight Network voice up-link/down-link windows. ✓

NOTES 5/8/67 HEIMBURG 5/8 9 AM B 5/16

1. S-IB A short duration test, SA-46, is to be conducted with Stage S-IB-10 on May 9, 1967 ✓

2. S-IVB (SACTO) S-IVB-503 (New) underwent a successful duration (approximately 461 seconds) acceptance firing on Wednesday, May 3, 1967, at approximately 6 p.m. PDT. The first attempt to fire was aborted shortly after engine ignition by the safety item monitor due to a "down" indication from one of the engine side-load restrainers. A stand inspection revealed the indication was erroneous and an adjustment was made on the restrainer microswitch to prevent a recurrence. An attempt was made to fire the stage O_2/H_2 burner several hours after the stage firing, but was aborted when the spool Delta P transducer read-out shifted. Since the facility supplied gases were running low, DAC re-scheduled the stage O_2/H_2 burner firing for Tuesday, May 9, 1967. ✓

3. S-IVB (MSFC) Test S-IVB-043 was conducted at the S-IVB Test Stand (MSFC) on May 3, 1967, for a scheduled duration of 150 seconds. Primary objective was to check the J-2 engine performance variations caused by the PU valve. ✓

4. S-IC STAGE (MTF) A successful propellant load test on the S-IC-4 stage was accomplished on May 4 and 5, 1967. A boroscope tip was lost in Engine No. 4 during inspection. It is suspected that a tip lost during inspection of Engine No. 1 may be in system. ✓

5. S-IC-S PRESSURE TEST PROGRAM The S-IC-S fuel tank will be removed from the test stand today. The short lox tank will be ready for installation in the test stand on May 9, 1967. ✓

6. S-II STRUCTURAL TEST PROGRAM The designs for Additions to Cryogenic Storage are complete. ✓

7. SATURN V GROUND SUPPORT EQUIPMENT We reported to you in the Swing Arm Status Meeting on Friday, April 28, that cracks had been found in one set of holddown arm base castings in the test area. KSC will try to repair one of the arms by welding. We think these cracks are very serious and have been urging KSC to inspect the other arms at the Cape. Inspection requires stripping paint from the casting. As of last Friday, no thorough inspection had been made on the arms at the Cape. We will keep you informed.

A meeting was held with Dr. Debus on Friday, May 5, 1967, to present the swing arm information we had given you on April 28. He left after only hearing half the presentation, however, he informed us that he had asked Boeing to propose on swing arm simplification for Set III, which we have in the test area. No schedule is yet available.

The ML-1 Damper Arm, contaminated and disassembled by Boeing at the Cape, was reported installed on the LUT last Friday. We had told you that we proposed to substitute ML-2 damper and re-test ML-1. KSC did not accept this. We expect them to have trouble checking out the arm.

8. MODERATE DEPTH LUNAR DRILL PROJECT Replies to the RFQ's are expected next week from Northrop and Joy and the week following from Westinghouse. The Test Laboratory designed down hole valve, required to operate the Joy hammer, was received and tested. One minor modification to the valve is required to optimize its operation. One test was conducted on the modified piston type compressor. Results showed the new valve design to be promising, but the intake valve requires modification to increase the flow capacity. ✓

NOTES 5-8-67 HOELZER

B 5/16

5/8 KS

DATA FOR EXPLORER IV: For the past four months the Data Reduction Branch has been working, on a "time available" basis, with Dr. Weber of St. Louis University in recovering telemetry data from Explorer IV. The data of most interest to Dr. Weber is that acquired around the ARGUS events of August 1958. Approximately 120 passes have been processed with the expenditure of 40 man-hours support contractor time.

NOTES 5-8-67 JOHNSON

5/8/67

B 5/16

Heat Pipe - MSFC Experiment # 37: Experiment was originally scheduled to fly in 207 IU. A similar experiment was recently flown by the AF to verify performance in zero-g environment. This test was a success. For this reason steps are being taken to have this experiment assigned to 212. This reassignment will provide time to develop a more meaningful scientific experiment with associated instrumentation system. ✓

Thermal Control Coatings - MSFC Experiment # 2: Experiment is incorporated in 206; however, because of the policy which disallows non-mission-related experiments on Apollo vehicles it must be removed. P&VE is preparing Engineering Change Request(ECR) required for experiment to be assigned to an AAP vehicle. Since structural inserts are required in the IU honeycomb to mount the experiment, installation at the Cape is not feasible - mod must be made during manufacture and assembly of IU. Therefore, 212 will be the earliest AAP vehicle for accommodating the experiment. ✓

Voyager Technology Panel: First meeting of Panel was held May 3 in Headquarters. Mr. Glahn, OSSA, is Chairman; Mr. Kee, OSSA, is alternate. Membership is comprised of representatives of LRC, JPL and MSFC (Mr. Jordan, ASO and Mr. Coons, EO, alternate). Panel is chartered to review Voyager requirements, coordinate Voyager-related advanced technology activities and advise SRT/ART organizations of specific needs. ✓

B 5/16

NOTES 5-8-67 KUERS

5/8958

No significant items to report. ✓

NOTES 5/8/67 MAUS

5/8 AM

B 5/16

1. SUPPORT CONTRACTOR MANPOWER - We have been informed that the Henderson Subcommittee is planning an investigation of NASA utilization of Support Contractors. Specific dates have not been announced. Chuck Pace from Paul Cotton's office will visit MSFC May 9, 1967, to walk through an explanation of the various numbers we have submitted during the past 12-18 months. ✓

A.M. Let's discuss this next Staff Luncheon B

A particularly sticky question results from the statements made last fall by several laboratory directors to a GAO audit team that it would take substantially less total people to accomplish the work if we would convert to a total civil service operation in their laboratories.

2. OMSF DIRECTIVES - A copy of the OMSF revised directive on Center Responsibilities is being reviewed to determine if there are any significant differences with regard to the Center position and responsibilities, including interfaces with KSC. None of the other OMSF directives, presently being revised by Dr. Mueller, are available for Center comment at this time and there will probably be no time for further review at Center level prior to Dr. Mueller's meeting with the Congress. ✓

3. MSFC ADP MANAGEMENT STUDY - We have coordinated the top management comments on the Booz Allen final draft reports and with Mr. Gorman's concurrence have forwarded them to Booz Allen and to the MSFC ADP Steering Group. Comments are summarized as follows:

1. "A Management Committee consisting of key personnel responsibly involved in a direct way with ADP Operations is more desirable than the establishment of a new position of Special Assistant for ADP resources."

2. "The study does not present sufficient evidence to warrant the relocation of Computation Lab at this time. It is possible that this move may appear more advisable in the future should operational problems develop as a result of our current organizational alignment."

3. "The proposal to establish a Slidell-type facility in the Research Park appears to be a good recommendation, but it is felt that MSFC should provide only technical assistance to GSA and promote their taking the lead in this operation."

4. "The Slidell Computer Facility was developed to specifically serve the Saturn Vehicle prime contractors. In this capacity, the day to day administration of the facility can best be handled through the IO organization. Major policy planning, operations review and interface problems will be handled by the established Management Committee." ✓

NOTES 5/8/67 RICHARD

5/8/67

B 5/16

AAP Payload Improvement Studies: Following the meeting with you on May 2, a meeting was held by the Technical Systems Office involving representatives from the Saturn/Apollo Applications Program Office, the Saturn IB Program Office, the Aero-Astrodynamics, Astrionics and P&VE Laboratories. The purpose of the meeting was to take the initial steps required to implement your May 2 direction. The detailed work assignments were made to the laboratories and offices which would put Marshall in a position to report in depth on the three primary schemes for improving our payload situation by May 18. We have referred the solid minuteman story to Frank Williams to handle in toto with the IB Project Office.

A separate action which we received from you during the May 2 meeting concerned the establishment of a Memorandum of Agreement describing the method of operation of the R&DO laboratories and offices and the IO Project Offices in implementing Apollo Applications Program requirements. We have not concluded a statement of agreement on this subject because of various interferences, primarily the Orbital Workshop Preliminary Design Review and the source selection procedures for the integration contractor. This office has, however, had separate discussions with the IB Program Office and with the Apollo Applications Program Office and has achieved a fundamental understanding with these offices regarding Apollo Applications Program execution, as affecting the Project Offices and the Technical Systems Office. We expect to have these agreements reduced to paper review by Wednesday of this week.

NOTES 5/8/67 RUDOLPH

5/8/67

B 5/8

1. S-IC-4 Stage at MTF: The captive firing of the stage is scheduled for Thursday, 11 May 67.

2. S-IVB-503 (new) Stage at SACTO: The stage successfully completed the acceptance testing with a captive firing of 442 seconds on Wednesday, 3 May 67.

3. S-II Stage - LH_2 dome to cylinder #6 weld offsets: Reference your comments on Notes 5/1/67 Kuers, attachment #1. A meeting on S-II Welding Improvement was held on Wednesday, 3 May 67, with Mr. Weidner, Dr. Hueter, Col Yarchin, Mr. Kuers, Mr. Grau and Mr. Kingsbury. Schedule slippage of S-II-7 in order to incorporate the new pulsed arc welding depends on the time required to complete design reviewing qualification testing, and welding certification. At present, this time is excessive; however, efforts are underway to reduce the time required. A decision is expected by Monday, 15 May 67.

4. Accidents at S&ID on Tuesday, 25 April 67: Reference your comments on Notes 5/1/67 Lucas, attachment #2. We are taking action through contractual channels to impose cost penalties on S&ID for negligence in allowing repetitive damaging incidents to occur to flight hardware.

5. S-II Stage Insulation Repairs at KSC: Due to numerous problems encountered with S-II Stage exterior insulation during cryogenic loading operations, we requested KSC to develop emergency procedures for repairing the insulation while the vehicle was on the pad, with cryogenics on-board. On Friday, 5 May 67, in meeting held at MSFC, Dr. Debus reiterated the KSC position that the personnel hazards for repairs of this type would be prohibitive. We are therefore initiating a comprehensive review of all insulation; prelaunch checkout procedures, launch requirements, etc., in order to assure maximum availability at time of launch. Mr. McCool (P&VE) has the lead on this action.

2 Attachments: Notes 5/1/67 Kuers/Notes 5/1/67 Lucas (DIR, I-DIR & R-DIR's copy only)

NOTES 5/8/67 SPEER

5/8/67

B 5/16

1. OPERATIONS MEETING AT KSC: A meeting jointly chaired by C. Kraft and R. Petrone was held at KSC on 5/2/67 to discuss major interface areas, especially operations schedules. Both Kraft and Petrone expressed concern about the present mode of developing operations schedules resulting in poor utilization of resources. It was agreed to develop joint KSC/MSC operations schedules based on hardware actually available at KSC. Our Flight Control Office participated in this meeting. ✓

2. AS-501 MISSION RULES: The initial launch vehicle inputs to the AS-501 launch mission rules have been reviewed within MSFC and are essentially firmed up. Some further analysis is required on a few open items such as the "Mandatory" classification of all Single Side Band (SSB) Telemetry Links; the possible requirements for the Communication Command System (CCS) for contingency actions; and the six "Mandatory" measurements required for 2nd burn post-flight evaluation. We expect to have a final position on these items for the Saturn V Program Managers Review scheduled for May 17. ✓

3. AAP FLIGHT OPERATIONS: We are working with I-S/AA and R-TO to identify any possible application of AAP test simulation equipment and software for real-time mission support. This support would be primarily to assist in malfunction identification during the mission. ✓

4. VOYAGER: Dr. C. Gates has been appointed Manager of the Voyager Mission Operations System (MOS). This will delay somewhat our planned series of discussion on MOS. Gates is one of the best people JPL has for this job. → I agree! B

5. APOLLO AIRCRAFT (ARIA): We participated in a briefing to Gen. Stevenson on planning and status of ARIA operations. These aircraft will provide essential telemetry recording during 2nd S-IVB burn. No significant problems are apparent at this time. Mr. Golden of Mission Operations will serve as MSFC representative on the Ship and Aircraft Working Groups. ✓

6. MSC OPERATIONS INVESTIGATION: MSC has initiated a major activity to review all facets of flight operations with regard to flight safety. The following areas are under investigation: flight control procedures; test integration; flight control data system integrity; and flight control data requirements. Our Flight Control Office has been requested to participate. ✓

NOTES 5-8-67 Stuhlinger

1. ATM-CONTAMINATION: A contract was negotiated with Ball Brothers Research Corporation (BBRC) for a 90-day continuation of the ATM optical environment contamination study. Jack Horton (P&VE-ME) is an alternate to Ray Hembree (SSL), who is technical supervisor of the contract.

2. ATM-CONTAMINATION: In following the development planning for experiments to be flown by Mr. Bonner (MSC) to collect minute space debris on exposed surfaces during Apollo flights, our impression was strengthened that the MSC experiments will not provide all (nor even most) of the objectives of our planned sample array experiment. Therefore, we will continue our contractual work with Martin which includes the study of real time monitoring of contaminating deposits on sample surfaces during the ATM mission.

3. APOLLO COATINGS: We were informed by Ed Luedke of TRW that MSC had given TRW the full problem of defining Apollo thermal control coatings. TRW is interested in the reflectometer developed by Gerhard Heller's group, together with Astrionics, for analyzing in-flight thermal properties, and they may propose this instrument to MSC.

4. RELATIVITY EXPERIMENT: The Schiff-Stanford zero-g gyro relativity experiment was described at MSFC on Monday, May 1, by Dr. William Fairbank, Dr. Daniel DeBra, and Dr. C. W. F. Everitt of the Stanford Physics Department. Members of ASO, EO, Astrionics, and SSL participated. The experiment consists of the measurement of a 7 arc sec deviation per year of the annular momentum vector of a very special gyro. The proposal has already aroused great interest and support in the scientific world. So far, the engineering problems appear surmountable to members of the MSFC Labs, but many practical problems must be solved first.

SSL has been planning to offer to you a presentation on suggested relativity experiments in space, including the Schiff-Stanford experiment. Would you be interested in such a presentation? Yes B

5. HIGH-VELOCITY RANGE: A new velocity sensing system has been installed on SSL's hypervelocity range which will greatly increase our flexibility of operation and will offer improved reliability over the photomultiplier system now in use. We are now using fotofets (photo sensitive field transistors) with solid state preamplifiers and emitter followers packaged in a small cube. One detector is mounted in the blast tank and senses the muzzle gasses and the other senses the impact flash. We can now operate at high vacuum since we no longer need the 2-10 mm Argon previously required by our photomultiplier system. The system has been checked out and is operating satisfactorily.

6. EMR-QUESTION ON 4/24 NOTES (Copy attached): "Sensitive" means that this information was received by courtesy of one of the NRL members, and should not be used outside MSFC until the Space Science Steering Committee has passed judgement on the EMR and its proposed experiments. On May 2, the SSSC did discuss the proposed EMR project; the project passed with flying colors. We will keep you informed of further developments.

The EMR gamma balloon flight took place on May 7 and 8. It was apparently completely successful. We will supply details next week.

NOTES 5/8/67 TEIR

5/8/67

B5/11

USE OF CARBON TETRACHLORIDE (CCL_4) ON EASTERN TEST RANGE: An Air Force regulation restricts the use of CCL_4 on Air Force property. CCL_4 offers the only available method to assure that our ST-124M platform performance is not degraded due to an unacceptable amount of condensable hydrocarbon in the GN_2. For the past ten years, both MSFC and contractors have sought a suitable alternate method to the CCL_4 scrubber technique. Total cost of contractor effort to date is approximately $510,000. ETR has granted a waiver for the use of CCL_4 until June 25, 1967. We will meet with ETR late this week or early next week to explain our requirement, our efforts to develop a suitable alternate method, and our precautions which make our CCL_4 technique safe.

MOVEMENT OF RCA MODULE BOARD REWORK FROM VAN NUYS TO HUNTSVILLE: RCA began rework operations at the Huntsville facility on Monday, May 1, 1967. During the first three days, 108 printed circuit boards were completed through the soldering operation. In our opinion, the Huntsville operation is turning out more quality boards than Van Nuys after eight months of operation.

AAP PAYLOAD IMPROVEMENT STUDIES: We met with R&DO and AAP office on May 3 to outline actions on these studies. R&DO has the lead on the nosecone/SLA jettison study. A change has been issued to DAC for the solid kick study and the restart. R-AS has the lead on the 4 Minuteman strap-ons for the S-IB stage. Additionally, CCSD under their systems engineering contract has been issued a task to assist R-AERO in the evaluation of these various uprating schemes. Maximum effort of all parties is required to meet the established May 18th date for completing a quick feasibility and impact study. Center input is due for the AAP meeting in Washington on May 22.

AS-205 RENDEZVOUS EVALUATION POD: George Low informed Dr. Rees May 2 that MSC is studying the possibility of adding a rendezvous during the CSM-101/205 mission. MSC envisions two concepts: rendezvous with the S-IVB/IU the second or third day; if this is not feasible, rendezvous with a light Pod mounted in the SLA and separated after the CSM separates from the S-IVB/IU. Mr. Maynard, MSC, and I have established contacts within our respective Systems Engineering offices. We informed R&DO but have not given them a formal requirement pending output from an MSC in-house meeting with Mr. Low held May 5. MSC requested that we not proceed until after their meeting with Mr. Low. It is not clear at this time whether they actually intend to pursue the Pod approach or whether they will want to consider only the spent S-IVB/IU. If they still have the Pod requirement, they will provide us with a data requirement package and we will give R&DO the go-ahead.

NOTES 5/8/67 WILLIAMS

1. MOL Presentation:

I attended a DAC/AF briefing on MOL at Douglas on Friday, May 4, and reviewed the MOL Mock-up. Copies of the presentation material (unclassified) are being forwarded to me, and if you are interested, I will send a copy to you. We are revising the list of MSFC people to have access to MOL data, and I plan to include your name unless you advise to the contrary. (Just as a matter of interest, there was no new (or unknown) data presented on MOL that one couldn't have dug out of "open literature" with only a little effort.)

There were 16 MSC people in attendance (including Chuck Berry, Max Faget, Alan Shepard, Paul Purser, Bob Thompson, Bob Piland, etc.), myself from MSFC, and one man from KSC.

Also reviewed was a MSC study which DAC is doing on Application of MOL to AAP Missions. A more detailed review, including a complete rundown on sub-systems, will be held at MSC this week, and we plan to have "good" MSFC participation.

2. Improved Lunar Cargo and Personnel Delivery System:

The Improved Lunar Cargo and Personnel Delivery System study contract has been signed by both Lockheed and MSFC. The effective starting date is May 1, 1967.

May 15, 1967

BALCH NOTES 5/15/67

5/15 [handwritten initials] B 5/19

I. A. M. A. W. Strike - As a result of breakdown of wage negotiations between International Association of Machinists and Aerospace Workers (IAMAW) and Cook Brothers Leasing Company, a subcontractor to General Electric, I. A. M. A. W. went on strike beginning this morning and have posted pickets at both main entrances to the site. A preliminary survey indicates that members of all unions on site are refusing to cross picket lines to report to work; however, a definite assessment of the situation is not yet possible.

Current plans are to request the I. A. M. A. W. to picket at separate gates set up as the only access to the site by its members. This would enable members of other unions to report to work without crossing picket lines. If this request is refused, Federal court action will be sought to force compliance.

S-II-2 Stage - Stage was removed from the A-2 stand early this morning and is being transported to the S-II Vehicle Service Building. Shipment to KSC is still scheduled for 5/20/67. Turnover meeting to inform KSC personnel on status of stage was held 5/11/67.

S-IC-4 Testing - Primarily because of additional time required to check out and remove engine contamination and to check out indicated aspiration of LOX tank during LOX dome high purge with helium, static firing scheduled for 5/11/67 was postponed. If not prevented by strike and picketing of site by I. A. M. A. W., which started this morning, RP-1 tanking will be started today, 5/15/67, and static firing will be conducted tomorrow, 5/16/67.

S-II-A-1 Test Stand - Because of anticipated delay in shipment of S-II-3 stage from Seal Beach to MTF, the integrated test of the stand and GSE with simulated stage has been postponed to avoid a long interval between the simulated test and actual use of the stand for stage testing. Nine items remain open which must be completed by the Corps of Engineers prior to a static firing on the stand.

MTF Open House - The "Open House" conducted at MTF over this past weekend was very successful. Total visitors for both Saturday and Sunday is estimated at 14,000.

NOTES 5/15/67 BELEW

B 5/19

5/15/67

ORBITAL WORKSHOP PRELIMINARY DESIGN REVIEW (PDR): MSFC and MSC teams completed the review of all actions resulting from the PDR. Roughly 104 actions have been jointly agreed to and signed off by the two Centers. It is planned these actions will be reviewed with Mr. Chuck Mathews this week for program approval. In the meantime, many activities have begun responding to the PDR out puts.

ATM: In conjunction with Astrionics, we reviewed the MSC statement of work for the Grumman Aircraft Engineering Corporation (GAEC) Phase "C" final definition effort for the LM/ATM and provided informal comments to them.

On May 17, Langley Research Center plans to conduct a formal review of their efforts to date in support of the ATM pointing control system.

On May 5, we discussed with Mr. Mathews the addition of a 3-foot Instrument Unit (IU) section to the ATM launch vehicle. While he was not pleased over the associated weight increase of 450 pounds, he did agree that the change appeared necessary. He asked that we document to him our recommendation and that he would provide affirmative direction in writing to us and the other Centers.

CLUSTER 1 EXPERIMENTS: Headquarters is pursuing the possibility of a single mission vehicle prior to the cluster flight. This launch would accommodate the Lunar Mapping & Survey System (LM&SS) and several experiments which have been planned for the cluster flight. In addition to the reduction of the number of experiments, this also increases the number of days available for Workshop-related experiment performance from 11 to 16 due to no LM&SS.

MULTIPLE DOCKING ADAPTER (MDA) DOCKING HARDWARE: As a result of discussions held with MSC to date, it appears that NAA may not be able to support our MDA docking hardware delivery requirements. Some of the problems are: redesign of some of this hardware both for improvement changes and make work changes, long lead time material procurement. R-P&VE and R-ME have evaluated the possibility of producing the structural portions of this hardware utilizing NAA drawings.

LAUNCH VEHICLE PERFORMANCE IMPROVEMENT FOR AAP MISSIONS: A meeting has been scheduled for May 18 for interim reports on the performance improvement studies initiated as a result of the recent meeting on weight and performance with you. Douglas Aircraft Corporation, Chrysler Corporation Support Division and R&DO will present study results.

AAP LUNAR PLANNING AD HOC STUDY TEAM: The two day meeting of the AAP Lunar Planning Ad Hoc committee to be held at MSFC this week has been postponed one day to May 17 and 18. Grumman plans to present the method of effecting an unmanned landing of a cargo carrier lunar module, emphasizing the benefit and experience which will be gained from the LM/ATM program as applied to the lunar surface activities.

THE EFFECT OF NEW AAP SCHEDULES: The effect of the revised AAP schedule on the AAP lunar surface missions is being considered. As a noteworthy change in the new schedule is a possible reassignment of the 1970 "one to three day" lunar mission hardware back to Apollo with retention of the 1971 dual launch surface mission. Hence, the new schedule continues to require a FY 68 start for the LSSM and for modifications to its LM carrier.

B 5/19

NOTES 5-15-67 BROWN

F-1 ENGINE The borescope inspection of the engine LOX injectors on S-IC-4 has been completed. The engines were found to be clean with the exception of engine F-5031, which contained a small metal sliver that was successfully removed. Although the inspection was conducted in accordance with Engine Field Inspection Request (EFIR) F1-29, considerable confusion resulted from correspondence generated by the MSFC Laboratories and S-IC Stage Office, which Boeing interpreted as authorization to perform the effort. Several anomalies occurred during inspection such as, parts of the borescope being dropped into the engine. Considerable additional time was required to locate and remove the borescope parts. Rocketdyne initiated an in-house training program to provide skilled technicians and techniques to perform these inspections. The utilization of trained Rocketdyne personnel and formalized procedures should be the only recognized means of accomplishing these inspections. The borescope inspection on Vehicle S-IC-2 and -3 will be performed at KSC when the vehicles are in the vertical position. Trained Rocketdyne personnel and approved procedures will be used for all subsequent injector inspections.

Hmm. Neither I thought we had this type of thing under control. Please tighten up procedures with EDO. B

An evaluation of the problem, previously reported, on primary LOX seal mating ring failures caused by use of abnormal carbon material is complete. Because of this evaluation replacement of these seals in the applicable engines was necessary. This effort has been initiated under EFIR 28 and is now in process. No schedule impact is anticipated, based on current working schedules.

H-1 ENGINE During the first static firing of S-IB-10, engine H-4090 performed at 209.6K sea level thrust. All other engines were within the 205 + 3K model specification. The engine is being inspected for discrepancies that could cause increased thrust. If no problem is found, the engine will be re-orificed prior to the next static firing.

J-2 ENGINE There were three successful S-II simulation tests at AEDC Tuesday, May 9, 1967. These tests simulated worst case S-II start conditions. Worst case S-II conditions are related to extremely cold components, the opposite of worst case S-IVB restart conditions, where warm components are the problem. The results of the test last week were as predicted, no anomalies.

A successful 50-second S-II Battleship test was conducted May 12, 1967. The propellant residuals were programmed to simulate a flight cutoff condition. Engine inlet temperatures showed a slight rise; however, they remained within limits.

All engine work was completed Saturday, May 13, 1967, on S-II-2.

B 5/15

NOTES - 5/15/67 - CONSTAN

5/15/67

Nothing of special significance.

B 5/10

NOTES 5/15/67 FELLOWS

5/15/67

FY-67 Budget Execution: R&D Operations accomplished and surpassed its Saturn-Apollo Program Annual Plan this fiscal year for the first time. As it became apparent that the $99.3 M FY-67 Plan would be completely initiated by the laboratories and urgent requirements still remained, approximately 7 M additional dollars were requested from IO. Following full discussions between Mr. Cook and Mr. Hueter of our technical requirements and ability to initiate funds rapidly, 4 M additional dollars were made available during the last month. The laboratories responded with approximately $7 M in procurement requests so that the highest overall priority items could be covered with the $4 M and be completely ready to support hard-core requirements with the remaining $3 M funding which had been requested from IO. Discussions with IO are continuing to obtain the additional funding.

NOTES 5/15/67 GEISSLER B-5/12

1. Mission Requirements Panel (MRP): First meeting of AAP MRP took place at MSC May 2. Panel and sub-panel scopes, organization, operation, action items, and agreements were discussed. It was agreed that MRP proper shall limit itself to review, direction, and coordination of its sub-panels, and that it should concern itself with MSC/MSFC interface problems, and not become involved in discussion of line responsibilities. Action items were: Mission requirements Sub-panel of MRP shall present review copy of Mission Requirements document for AAP 1-4 at next MRP meeting; Guidance and Performance Sub-panel will (1) determine details of passivation and its effects on rendezvous for AAP 1 & 2, (2) investigate various means of optimizing mission performance and suggest most feasible one, (3) evaluate requirements for orbital attitude control system for S-IVB (AAP 2 & 4), (4) define solar panel deployment and operation sequence (AAP 2 & 4), (5) determine aerodynamics of various cluster configurations and corresponding orbital lifetimes, and (6) determine CMG control and dump procedures; and Experiments Sub-panel will (1) prepare list of experiments requirements and (2) define its scope and planned procedural operations. Considerable time was utilized to discuss panel operation in establishing mission requirements Vs. unilateral establishment of mission planning by Mission Planning and Analysis Division of MSC. Generally speaking, there seems to be no major disagreements, but I would anticipate some problem in reaching agreement with MSC in joint preparation responsibility of Preliminary Reference Trajectory, Reference Trajectory, and Operational Trajectory.

2. Solar Cycle Prediction: A critical parameter in orbital lifetime prediction is upper atmospheric density and its variation with solar activity. As a result, our predictions currently depend largely upon how well we are able to predict solar acitivity, i.e. sunspot cycle. Recently, Mr. John Nelson of RCA and Dr. Richard Head, Ass't Director of ERC presented results of their research activities. Both employ planetary ephemeris in their work. Mr. Nelson predicts communication conditions for RCA, based on relative angular position of planets, and his work is closely tied to prediction of geomagnetic storms and their effects on ionosphere. He has had 90% accuracy, a persistently good score over the past 16 years. Dr. Head uses a similar but more sophisticated approach and concentrates on solar flare prediction. He provides his data to LRC and JPL for Lunar Orbiter work. For example some of Dr. Head's current solar flare predictions (medium or better probability of occurrence for class 2 or higher flares) are May 22, 24, 27; June 9, 26, 28; July 1, 4, 24; Aug. 6, 26; Sept. 15 (all 1967 dates). Dr. Head has formulated analytical expressions for planetary gravity force vectors using change in magnitude and direction of resultant planetary gravity vector as criterion for solar flare excitation. He provides solar cycle predictions upon request. His studies are not completed yet, but promise to produce dramatic improvements in predictability of major solar outbursts many years ahead. He has identified tentatively a period of 178 years in sunspot activities. This will obviously be very significant for manned missions and may eventually lead to long range weather predictions. We shall invite Dr. Head to repeat his talk at our Environment Induced Orbital Dynamics Seminar here June 6. We plan to obtain ERC's computer programs and improve and adapt them for our use. Our current solar cycle prediction method is based on best known statistical extrapolation from previous observations.

NOTES 5-15-67 GRAU

6/16 RD

B 5/19

1. S-IVB PROGRAM: S-IVB-205 is tentatively scheduled to be shipped to KSC June 29, 1967. The stage has been in storage at Sacramento since July 6, 1966. In the one year period between completion of post-static checkout and shipment to KSC, a minimum of 93 Work Release Orders (WRO) will have been worked against the stage. The storage time and WRO's that have been worked against the stage have invalidated portions of stage testing performed at Huntington Beach during post-manufacturing checkout, and at Sacramento during pre-static checkout, static firing, and post-static checkout. There is no retest schedule at Sacramento. We are taking action to make IO aware of retest requirements. Due to the exposure of S-IVB-205 and S-IVB-206 to heavy rains and winds during temporary outside storage, we have submitted requirements for inspection and subsystem revalidation to the Stage Office. ✓

1.0.

What's your reaction?

B

2. IU PROGRAM: Checkout of IU-208 is progressing satisfactorily. G&C systems tests are beginning. The outside IU skin was damaged when high pressure nitrogen whipped a GSE fill line into it several times. IBM states it will be no trouble to repair. IU-503 is progressing satisfactorily through checkout. An engineering investigation that has been underway on bonding problems kept power off the unit for three days. The schedule for this unit has been extended into June, relieving IBM of the requirement to run a second shift. IBM ran several tests on second shift with no government coverage, but the tests are scheduled for rerun. ✓

3. STAGE CONTRACTOR CHECKOUT PRACTICES: With reference to your comments on my NOTES of 3-27-67 and 4-24-67 (copies attached), we are working on the problems in these areas, and have made our requirements known to the stage offices. Results are not yet conclusive. I will keep you informed of further developments. ✓

1.0.

B

ATTACHMENTS: NOTES 3-27-67 GRAU, NOTES 4-24-67 GRAU (Dr. von Braun's and Mr. Weidner's copies only)

NOTES 5/15/67 HAEUSSERMANN

5/15 KS

B 5/12

1. ATM. The following course of action has been decided on for the ATM Digital Computer System:

a. Initiate the design, development and breadboard activities for the Input/Output part of the system under contract NAS8-14000 (IBM/IU contract). The Input/Output is the pacing item of the system.

b. Proceed via short procurement form to procure the IBM 4 Pi computer and the Input/Output hardware for the flight vehicle, prototypes, etc. NASA Headquarters will have to approve this procurement action before we can start negotiations with IBM.

This course of action has the concurrence of IO/AAP and is based on Mr. Mathews' recognition of our need of a digital computational capability. Ability to meet the presently planned schedules of NASA Headquarters for AAP requires that we move out as specified above. Subsequent to our presentation on this subject to Mr. Mathews on April 27, we have not been able to meet with Mr. Mathews to determine what position NASA Headquarters will take but we do believe that there is not any gross disagreement with our approach.

NOTES 5/15/67 HEIMBURG

5/16 9 CS

B 5/19

S-IB

Test SA-46, a 35 second test, was successfully conducted on stage S-IB-10 on May 9, 1967. The duration test SA-47 is scheduled for May 22, 1967.

S-IC STAGE (MTF)

The S-IC-4 stage acceptance firing was delayed from May 11 to May 16, 1967. Delay was caused by a combination of three problems: (a) Completion of borescope inspection of engine lox domes (b) problems of under-pressure on lox tank caused by aspiration effect of engine lox dome purge during sequence tests when prevalves and engine main valves are opened with vents closed (solution was effected by decreasing purge flowrate for sequence tests only. Resultant 0.8 inch of water under-pressure was okayed by Boeing Engineering), and (c) large volume of paper to be closed out prior to firing.

S-IC-S PRESSURE TEST PROGRAM

The S-IC-S fuel tank was removed from the test stand on May 8, 1967. The S-IC short lox tank will be installed in the test stand today, weather permitting.

S-II STRUCTURAL TEST PROGRAM

The design for Additions to Cryogenic Storage was approved last week. Facility construction continues on this phase.

MODERATE DEPTH LUNAR DRILL PROJECT

A reply to the RFQ to Northrop was received in Test Laboratory and is being evaluated. Their total target cost quotation was $118,615.

S-II-2 (MTF)

Cold flow test of A-1 Stand is scheduled for May 18 and 19, 1967.

S-IVB (SACTO)

The O_2/H_2 burner portion of the S-IVB-503 (New) acceptance firing was successfully conducted on May 8, 1967. The burn time required to re-pressurize the LH_2 tank to 34 p.s.i.a. was approximately 235 seconds. All parameters appeared normal. S-IVB-209 is expected to be installed in the Beta I Test Stand about May 15, 1967, with the acceptance firing on June 14, 1967.

NOTES 5-15-67 HOELZER

5/15/67

B 5/19

NEGATIVE REPORT.

NOTES 5/15/67 JOHNSON

5/15 9:15

B 5/19

Status of Flight Experiments - Because of an increased workload in several of the laboratories arising from the ATM, Workshop, and Voyager, and because of uncertainty about near-future flight possibilities on Apollo and AAP vehicles, a number of the experiments proposed for flight by the laboratories are now being re-evaluated. We are working with the laboratories in this re-evaluation in an effort to classify and "grade" all candidate experiments. A meeting of the Marshall Experiments Review Board is scheduled for 6/15, at which time the status of the program, including the status of individual experiments, will be discussed. Following this, several meetings of the Board are planned to examine in detail the remaining active experiments. It is expected that only about 25-30 of the experiments now being considered will remain on the active list.

FY68 SRT Programs - The tasks proposed for the FY68 SRT programs have been reviewed and are being prepared for submission to Headquarters Program Offices. The funding level requirements are:

Program	Guideline	Submitted
OSSA	2,400,000	3,406,000
OART	21,385,000	39,057,000 *
OTDA	1,000,000	1,015,000
OMSF	10,000,000	9,832,000 **

* includes contingency submission of 15.6M for NGTM work

** does not include J2-S/J2-X Engine requirements which are being submitted separately

OART FY69 Program Review - Mr. Miles, Mr. Napper, and I attended the annual OART program planning meeting in Headquarters on 5/9. This first cut plan showed requirements of $528M for R and D and $120M for C of F. The executive session, on 5/10, was scheduled to scale these down to about $350M and $20-30M respectively. Revised planning figures are to be available sometime about mid June. The original estimates of requirements contained about $30-35M of new work for MSFC, largely in Nuclear and Chemical Propulsion.

NOTES 5-15-67 KUERS

5/15 gKD

B 5/19

Manufacturing Technology Review: A Manufacturing Technology Review meeting sponsored by ME Laboratory, and hosted by the Rocketdyne Division of North American Aviation, Inc., is scheduled for May 24-25, 1967, at Los Angeles, California.

The objective in conducting this review is to promote an interchange of data on current space vehicle manufacturing technology and management techniques in the interest of continued improvements in the manufacturing segments of the aerospace industry.

Presentations will cover a broad spectrum of recent pertinent manufacturing developments, with special emphasis on subjects not as yet covered by review. Conducting the presentation will be representatives from IBM, Aerojet-General Corporation, The Boeing Company, Douglas Aircraft Company, Grumman Aircraft Engineering Corporation, McDonnell Company, North American Aviation's Los Angeles, Space Systems, and Rocketdyne Divisions, and NASA's Marshall Space Flight Center.

Mr. Walter Burke will make the introductory presentation on manufacturing technology experience gained in the Gemini Program. We have organized such manufacturing technology meetings in previous years and believe that there is a real need for such reviews. In order to achieve maximum benefits for our program we try to get together the leading men who are actually responsible for the manufacture of the stages and spacecraft modules. Also, we keep the number of attendees for each of the 16 sessions small enough to stimulate informal discussions between the participants. I would like to extend a personal invitation to you to participate in this meeting.

D.K.

I wish you would concentrate first on our own inter-Apollo manufacturing problems in these most worth-while Manufacturing Technology Review meetings. While general crossfeed of manufacturing know-how throughout the Aerospace Industry is a fine objective, those S-II cracks still excite me a great deal more!! B

NOTES 5-15-67 LUCAS

B 5/19

1. ORBITAL WORKSHOP PDR: Following the formal portion of the PDR last week, representatives of MSFC and MSC continued to work together until agreement was reached upon all the 104 RID's (Review Item Disposition) resulting from the PDR. Chuck Matthews will be here tomorrow, we understand, to review a summary of this exercise. From the 104 RID's, 200 actions resulted (77 actions for MSC and 123 actions for MSFC and DAC). Follow-up dates for each item were agreed upon.

2. STRESS CORROSION SYMPOSIUM: I have been asked to head a sub-committee of the NASA Materials Research Advisory Committee to organize a one-day symposium to be held at the Ames Research Center in October 1967. Professor Milt Shaw of Carnegie Tech and Bob Johnson, MSC, are also on the sub-committee. The advisory committee is composed of materials experts representing each NASA Center, AF, Navy, AEC, 6 aerospace companies, JPL, Mellon Institute, National Academy of Sciences, and 3 leading universities. Hopefully, this symposium will result in a resolution by the advisory committee directed to OART relative to a comprehensive stress corrosion research program. I expect to accept the assignment because I proposed the symposium in the first place, and because of the potential benefit to NASA and to MSFC especially.

3. VOYAGER VENUS AND JUPITER MISSIONS: Preliminary spacecraft designs have been generated for the Venus and Jupiter Voyager missions. Payloads for these designs to Venus were 3600 pounds and 2700 pounds, respectively. For Jupiter, similar payloads were 1050 pounds and 700 pounds, respectively. The philosophy used in determining these payloads was maximum use of Saturn V launch vehicle injection capability and use of existing ground rules of the Mars Voyager mission, where possible. For the Venus mission, the payload quoted is that for each of two planetary vehicles injected per mission. For Jupiter, only one planetary vehicle could be injected per mission by the Saturn V launch vehicle.

4. VOYAGER SPACECRAFT PROPULSION TYPE SELECTION: OSSA directed MSFC to select a propulsion type (liquid or solid) for the Mars Orbit Insertion Propulsion System by July 1, 1967. Plans to implement this decision are under way.

5. VOYAGER: Meetings were held on May 3 and 4 with dynamics personnel from Langley Research Center to discuss overall Voyager vibration and acoustic specifications and test requirements. The ensuing discussion indicated excellent technical agreement and acceptance by Langley of our proposed program. Additional meetings are planned to develop the program with both Langley and JPL.

NOTES 5/15/67 MAUS

5/15/67

B 5/19

OMSF SAFETY REQUIREMENTS - Prompted by the Apollo 204 accident, Mr. Webb, Dr. Seamans and Dr. Mueller have testified to Congress on the actions taken or to be taken in strengthening NASA safety procedures and programs.

We are trying to obtain a copy of a safety directive presently under preparation by OMSF.

H.M. I'd like to see the letter B

We already have received a letter from George Trimble requesting center participation in development of NASA safety standards and procedures.

We are arranging a staff luncheon briefing to appraise you of the background available in this matter and to discuss possible alternate approaches which this Center might wish to take vis-a-vis Dr. Mueller's directive.

B 5/19

NOTES 5/15/67 RICHARD

5/15/67

No submission this week.

NOTES 5/15/67 RUDOLPH

5/15/67

B 5/12

1. S-IC-4 Stage at MTF: The captive firing of S-IC-4 Stage has been rescheduled from Thursday, 11 May 67, to Tuesday, 16 May 67.

2. AS-501 Primary Damper System: The Primary Damper, which was inadvertently contaminated and subsequently cleaned and reassembled by KSC, is now being checked and calibrated. If calibrations are satisfactory, the ML-1 Damper will be used on the AS-501 launch vehicle.

3. AS-501 Launch Vehicle Pre-Flight Review: My Pre-Flight Review will be held on Wednesday, Thursday and Friday, 17, 18 and 19 May 67, in the LIEF Conference Room.

4. S-II Stage LH_2 Dome to Cylinder #6 Weld Offsets:

o At the meeting with you, Dr. Lucas and Mr. Kuers on Friday, 12 May 67, it was agreed that:

- The MIG pulsed arc welding development will be expedited at S&ID.
- The welding of the S-II-7 Stage, Cylinder #6, will not be delayed just to include the MIG pulsed arc welding.
- In the event the schedule changes, and the MIG pulsed arc welding can be verified, it may be used as early as S-II-7, provided it does not create further schedule delay.

5. Boeing Integration Contract will Expand to Cover all Apollo Work:

o At the direction of the NASA Administrator, the MSFC Boeing Systems Engineering and Integration Support contract will be supplemented to provide support for the entire Apollo Program, including:

- New engineering and integration support to MSC.
- Strengthening of the Boeing test and checkout integration effort (both spacecraft and launch vehicle) at KSC.
- New support to the Apollo Program Director, including:

a. Reviewing proposed spacecraft/launch vehicle interface and/or engineering changes (Level I CCB actions).

b. Reviewing the readiness of stages for shipment from manufacturing and test sites.

c. Assisting in Flight Readiness Reviews, Critical Design Reviews, etc.

6. Contractor Reviews: In accordance with request from Lee James (Hq) to Dr. Rees we have sent copies of important reports, assessments, audits, meeting minutes, etc., to MSF which indicate that MSFC and NASA top management have continuously been reviewing the activities of other contractors in a method similar to the General Phillips review of S&ID.

NOTES 5/15/67 SPEER

B 5/19

5/1598

1. AAP OPERATIONS MEETINGS: The Mission Director for AAP, Bill Schneider, has now scheduled periodic operations review meetings with the primary purpose of exposing top management to operations problems. The first meeting of this group was held here at MSFC on May 11 with respresentatives from all MSF operations organizations and GSFC. Two action items were accepted by MSFC: (1) Provide Range Safety with sufficient data to enable them to assess the feasibility of supporting a launch azimuth with a resultant high inclination (50°) orbit. (2) Determine the ATM PI's requirements for direct voice communications with the astronauts during an ATM mission. Present procedures will not allow this. A status report on these items is due to Schneider by May 29. The next meeting has been tentatively established for June 13. We will assure adequate MSFC representation at future meetings. ✓

2. VOYAGER MISSION OPERATIONS WORKING GROUP MEETING: The first meeting of this group, recently established by the Mission Design Panel, was held at JPL on May 11. Among the specific action items assigned, MSFC was asked to analyze the requirements and alternatives for conduct of launch vehicle flight operations. There was a strong feeling among several of the representatives, particularly Langley, Surface Laboratory and MSFC, that the majority of the specific work proposed for the group could be better done by individual systems or through other planned interface groups. Further discussion in the Mission Design Panel appears required.

F.S. What do you mean by that? B

3. PROPOSED CHANGE TO THE APOLLO LAUNCH DATA SYSTEMS (ALDS): Kraft (MSC) has recently asked MSF, KSC, and MSFC to comment on several options for changing the configuration of the ALDS. The ALDS system is used to collect and transmit to MCC-H the real-time launch area telemetry data required for flight control. One of the options, which GSFC and MSC are believed to favor, would eliminate the present KSC role (particularly the use of the Central Instrumentation Facility) from the system. KSC opposes the change options, and MSF has requested a full briefing before any further consideration of changes. We also oppose the MSC proposal based on the information we have, at this time, due to: (1) Possible degradation of launch vehicle flight control data; (2) Indirect effects on the LIEF data system; and (3) Changing a proven system without sufficiently thorough consideration of all aspects, including future AAP needs. However, some modifications of the present system may be in order to reduce unneeded bandwidth capability with resulting cost savings. ✓

NOTES 5-15-67 Stuhlinger

5/15 SS

B 5/19

1. VOYAGER REVIEW AT VOYAGER INTERIM PROJECT OFFICE: A Voyager review was held by Don Hearth in the Pasadena Office on 5/8. Dr. Pickering, Dr. Findlay (Planetary Missions Planning Board), Oran Nicks, John Naugle, Bob Fellows and about 70 others from Headquarters, LaRC, JPL, and MSFC were present. Considerable interest was shown for the "hypothetical science program" which Bob Fellows had asked us (Dan Hale) to develop. Our list of "sample experiments" aroused much debate, but the list, and particularly the priorities we had attached to the experiments, found much positive reaction. Dr. Findlay requested a presentation of our hypothetical program to his Board in June, saying: "We will tear it apart, but we will put it together again, and I have no doubt that it will look pretty much as you have it now." We appreciate this invitation from the Board, because it will help us to arrive earlier at an accepted sample package which is badly needed for the engineering layout of the Voyager Spacecraft System, and provide an opportunity for gaining the Board's confidence.

2. ATM-FILM FOGGING: Members of SSL will be at Harvard on Wednesday and Thursday, May 17 and 18 to irradiate the following Kodak films: 103-0, SWR (Impoved 7 type), SC-5, SC-7, Panatomic-x (3400), and Plus-x (3401).

Each film type will be exposed to six different proton doses at incident energy levels of 50, 90, and 130 MeV. Kodak will furnish some additional film for us to irradiate. This film will be processed and handled by Kodak and will serve as an independent substantiation of our results.

3. EMR (ATM-0): The gamma ray balloon flight, carrying the germanium-lithium detector of the ORNL (Dr. Gibbons) experiment for EMR, was launched from Palestine, Texas, at 8 p.m. on 5/8. It was a perfect success. The gamma ray count increased as the balloon rose to 35 km (117,000 ft.). This "background" is primarily due to by-products of collisions between primary cosmic rays and upper atmosphere nuclei. The balloon experiment was undertaken to provide criteria for the shielding design of the EMR experiment, but it proves now to have intrinsic scientific value in addition to its prime objective. The gondola with data system, power source, structural elements etc., was built by SSL from components obtained from ASTR and ME. Test Laboratory assisted in checking out the complete experiment, and we will be working with COMP in reducing the data.

At 1:30 a.m. on 5/9, it became evident that the balloon was a "Gulf seeker", drifting over Louisiana in a southeast direction. The balloon was commanded down at 2 a.m. A few hours later, the gondola was recovered by NCAR from a tree in a Louisiana swamp, in the most difficult recovery we have ever encountered." The equipment was in excellent condition, and the flight objective was fully achieved.

Dr. Nancy Roman informed me that the EMR (ATM-0) Project has met with full endorsement by the SSSC, and that OSSA has requested MSF (Chuck Mathews' Office) to include the project in the AAP integration study effort.

NOTES 5/15/67 TEIR

5/15 GPS

B 5/19

DELAY OF S-IB-10 STATIC FIRING: We have taken action to delay the static firing of S-IB-10 from May 17 to May 22 so that is can be observed by Vice President Humphrey during his planned visit to MSFC. ✓

AS-205 RENDEZVOUS EVALUATION POD: As stated in my notes of last week, MSC had indicated a possible requirement for a rendezvous during the CSM-101/205 mission. We received a TWX from MSC last week indicating they are favoring the rendezvous with the S-IVB/IU rather than the pod providing the mission planning indicates sufficient S-IVB/IU orbital lifetime can be provided. R-AERO has been analyzing the various lifetime versus orbital attitudes that can be provided and it appears that sufficient lifetime can be made available. MSC has agreed that SPS propellant can be off loaded to be compatible with the launch vehicle payload capabilities at the required attitudes. Until the S-IVB/IU lifetime analyses are completed and the required orbit determined, MSC will continue to investigate the pod. They have asked us to provide lifetime information on the pod to assist in their studies. We are working this with R-AERO. ✓

ALUMINUM FOIL LINER FOR S-IVB ORBITAL WORKSHOP: Within the thermal control system for the Orbital Workshop, a requirement for the aluminum foil liner to have a surface finish to provide a certain emissivity factor has been established. To satisfy this requirement, the aluminum foil installation procedure will have to be changed and verified. In addition, the Orbital Workshop Preliminary Design Review just concluded at MSFC has presented the possibility of going to a thicker layer of foil in the fuel tank for increased fire retardation. This too will require additional testing. DAC has developed a plan which will permit the installation of the AAP modifications on S-IVB-212 after manufacturing checkout with no schedule impact. This change in operations will permit more time for test and evaluation of AAP requirements. ✓

NOTES 5/15/67 WILLIAMS

5/15 9a

B 5/19

1. Boeing Study of 1 1/2 Stage Saturn V (S-IC):

As you requested, I contacted Dick Nelson (via Ted Snow) and we will get together with Boeing shortly and initiate an in-house review of their effort. I will advise you of our plans/schedule and when a presentation will be ready for your review.

2. Deputy Director, SNPO:

Dave Gabriel has been named Deputy Director of SNPO. Mr. Gabriel is an NACA/NASA veteran of Lewis Research Center but has been with Bell Aircraft for the last year. Mr. Gabriel held a responsible management position in the Centaur program at Lewis and hence has a vehicle oriented background.

3. NERVA Thrust Level:

SNPO has recommended a 200K thrust level for the NERVA nuclear rocket engine. Dr. Adams has in turn made this recommendation to Dr. Seamans. ASO studies show that there is relatively flat optimum from 200K to 250K, and considering other facets associated with the thrust level choice, we find no basic fault with their recommendation.

4. Local Scientific Survey Module (LSSM):

R-AS-PO (Mr. Bradford) received a letter from "Deke" Slayton (MSC) stating that the LSSM should be designed to accompany two astronauts EV at all times. This was in response to a question raised during an LSSM Technical Panel meeting. Mr. Bradford called Mr. Slayton and suggested that, because of the magnitude of the impact on LSSM and lunar surface planning, direction should be handled on a Center Director level. This was agreed to by both parties.

5. Space Station:

The MOL presentation at MSC outlined in detail the present Air Force configuration and subsystems, and touched very generally on essential modifications to increase orbital lifetime. They presented candidate configurations, and a selected approach will be made in the next week or so. The next phase will define a one-year NASA mission based upon the selected configuration.

MSC invited MSFC and Douglas to their mid-term presentations by Boeing (Saturn V launched space station), McDonnell (Logistics), and GDC (Basic Subsystem Module) on June 13-15 on the assumption that MSC and their contractors would be invited to the Douglas mid-term review the following week - which we had already done.

May 22 1967

GEORGE C. MARSHALL SPACE FLIGHT CENTER
HUNTSVILLE, ALABAMA

Memorandum

TO Dr. von Braun, DIR

DATE JUL 14 1967

FROM Engineering Program Manager, I-E-MGR

SUBJECT Contamination in H-1 Engine LOX Seal Cavity

Reference is made to my NOTES, dated 3/27/67 and 5/22/67, copies attached. The particular instance referred to resulted from engines contaminated by Chrysler during checkout at Michoud.

Your comments on my NOTES of 5/22/67 requested an outline of a plan for cleaning up the engine handling procedures from "cradle-to-the-grave" to stop the frequent mishaps (contamination) of the F-1, J-2, and H-1 engines.

We are aggressively reviewing operational guidelines for Rocketdyne Field Service Support personnel to make certain that we plug the loop-holes which allowed us to get into the H-1 engine LOX seal cavity corrosion problem. All checkout procedures involving engines are being reviewed to insure that correct operation sequences, operating parameters, and handling procedures are incorporated.

We are implementing working agreements for Rocketdyne Field Service support to stage contractors at all locations as a major effort to reduce the "goofs". The first step was to draft the agreement which you and Dr. Debus signed relative to Rocketdyne field service support to stage contractors at KSC (enclosure 3). This agreement was implemented by KSC Technical Instruction TI-2-11A (enclosure 4), effective June 13, 1967.

RECEIVED JUL 18 1967 DIR

On June 17, 1967 an agreement (enclosure 5) was coordinated with the Saturn IB program office defining the Rocketdyne-Chrysler working relationship at Michoud. A similar agreement is in process of being coordinated with the Saturn V program office defining the working relationship of Boeing and Rocketdyne at Michoud. We believe that these actions will substantially reduce the number of problems we have been encountering.

A. J. Burks
for William D. Brown

5 Enclosures
As stated

5/22 KS

B 5/25

BALCH 5/22/67 NOTES

S-II-2 Stage - Stage was shipped to KSC early Friday morning, 5/20/67, and is expected to arrive at KSC on Wednesday, 5/24/67.

S-IC-4 Testing - Stage was static fired at approximately 3:21 p.m., 5/16/67, for the full programmed duration of 125 seconds. Preliminary indications are that all test objectives were met and that there was no significant damage to stage or facility. Stage is scheduled to be removed from test stand on 6/1/67 and to be shipped to Michoud not later than the following day.

S-II-3 Stage - Information has been received that the S-II-3 stage may arrive at MTF from Seal Beach as late as 7/19/67.

S-IC-5 - Current plans are to ship the S-IC-5 stage to MTF on 5/6/67 and to change out Engines 3 and 5 at MTF instead of at Michoud. This will permit the test team to begin installation of instrumentation and stage/facility interconnections on schedule, which would not be possible if the engine changes were accomplished at Michoud prior to shipment.

I.A.M.A.W. Strike - Pickets posted by International Association of Machinists and Aerospace Workers last Monday morning, 5/15/67, as a result of a breakdown of wage negotiations with Cook Brothers Leasing Company, transportation subcontractor to General Electric, were removed about 4:45 p.m. the same day. Wage settlement arrived at in negotiating session on 5/19/67 was approved by local union membership on 5/20/67. Although approximately 500 man-days were lost as a result of this dispute, impact on MTF operations was negligible.

NOTES 5/22/67 BELEW

5/22 9 AM

B 5/25

AAP WEIGHT & PERFORMANCE: On May 17, we met with MSC to obtain an insight into our weight and performance situation as a result of the new Headquarters schedule, i.e., the two additional flights incorporated in the first cluster mission. As a result of this review, it now appears that we still have negative margins (reference to a weight target about 5 percent below launch vehicle capability) on the Orbital Workshop, AAP-3 CSM, and ATM flights ranging from 1,000 to 5,700 lbs. depending upon consumable distribution between the flights. We also reviewed the performance improvement schemes discussed with you on May 2, including solid kick motors on the S-IVB stage, Minuteman Strap-ons on the S-IB stage, and SLA panel jettison. We are continuing an analysis of these potential improvement schemes and have a review with MSC and Mathews in Washington on May 24 to review both the current weight and performance status as well as the potential performance schemes.

LANGLEY POINTING CONTROL SYSTEM REVIEW: On May 17, 1967, Langley conducted an impressive briefing on their status to date relative to their support of the ATM pointing control system. In brief summary, they have accumulated about 1300 hours on the Langley CMG; they have in operation a scaled model of the first AAP cluster; and have performed numerous analytical studies concerning control logic, dynamics, etc. The CMG unit tests have been quite successful, and they have encountered very few problems. From their analytical work, they, as did MSFC, conclude that CMG control alone will not provide the necessary ATM pointing accuracy when astronaut motion is considered. Langley plans to continue and expand their work in support of the ATM.

INSTRUMENT UNIT PROTECTIVE NETTING: An ECR to IBM on the instrument unit protective netting is being reviewed. The protective netting will protect the astronaut performing EVA in the IU area.

NOTES 5-22-67 BROWN

B 5/25

5/22 PS

J-2 ENGINE There were four successful S-II simulation tests at AEDC May 18, 1967. The first two tests simulated extreme cold conditions and the last two extreme hot conditions anticipated for S-II ignition. All the tests were successful with no engine damage. There are four tests planned for May 26, 1967, after which, if successful, the test cell will be down for three weeks for maintenance. ✓

F-1 ENGINE The F-1 engines installed on S-IC-4, started, operated and shutdown satisfactorily during the 125 seconds static firing at MTF on May 16, 1967. Preliminary data evaluation indicated there may be a slight increase in thrust (approximately 15K) on all five engines. An evaluation of the possible cause has been initiated, however, the thrust rise cannot be verified until the data has been reduced. Calibration of one of ten thrust chamber pressure transducers indicates the transducer was reading about 15 psi above the calibration values. ✓

Thru 1-Dir to Bill Brown

H-1 ENGINE H-1 Engine 7095 from S-IB-11(eleven) was disassembled at Neosho to inspect for corrosion in the LOX seal cavity. Corrosion in the seal cavity showed that an appreciable quantity of liquid had been present in the cavity for a considerable time. Because of the condition of this engine, the other three outboard engines from S-IB-11 are being returned to Neosho for disassembly and cleaning. Other engines that may have been contaminated are being inspected at Michoud. The results of the Michoud inspection should be available late this week.

H-1 Engine H-4090 that exhibited high thrust during the first static firing of S-IB-10 has been inspected, and no discrepancies noted. It has been reorificed to perform at specification thrust during the long static firing. ✓

The fact that we still have such problems with the 10-year old H-1 engine is most disconcerting. I think you ought to organize a cradle-to-grave review of all engine types in our program (H-1, J-2, F-1) to find the holes in our procedures that permit conditions such as this to exist. Please send me an outline of your plans for such a review. B

NOTES 5/22/67 CONSTAN

5/22 AS

B 5/25

STATUS OF S-IB STAGES

S-IB-4	Preparation for launch at KSC
S-IB-5	In storage at MAF
S-IB-6	Visual inspection and preparation for storage at MAF
S-IB-7	In re-checkout after changeout of 2 engines at MAF
S-IB-8	In storage at MAF
S-IB-9	In final functional checkout at MAF
S-IB-10	At Huntsville for long duration static firing on May 22, 1967
S-IB-11	Moved back into final assembly station for changeout and replacement of all outboard engines
S-IB-12	In final assembly - approximately 90 percent complete
S-IB-13 thru S-IB-16	Major long leadtime material is on order ✓

STATUS OF S-IC STAGES

S-IC-3	In re-checkout after incorporation of mandatory modifications
S-IC-4	Successfully static fired at MTF on May 16, 1967
S-IC-5	In storage at MAF; currently scheduled for shipment to MTF on June 26, 1967
S-IC-6	Post manufacturing checkout
S-IC-7	In horizonal assembly position with center engine installed and component installation on schedule
S-IC-8	The thrust structure, intertank and forward skirt are complete and LOX tank complete and awaiting availability of hydrostatic test position
S-IC-9	Thrust structure and intertank complete, forward skirt 65 percent complete, fuel tank complete, all components and assembly operation on schedule
S-IC-10	The components are being fabricated and on schedule ✓

B 5/25

NOTES 5/22/67 FELLOWS

5/22 WS

1. Procedures for R&DO Shipment to KSC: A series of meetings has been held with Colonel Montgomery, IO Resident Representative to KSC, to see how procedures might be improved for the shipment by R&DO of hardware to KSC. Lou Crouch has also been of valuable assistance by suggesting procedural aspects which might be clarified to broaden their understanding. The improved procedures will expedite timely delivery of these primarily non-flight items and clarify inspection requirements for the packaged material both here and at KSC. ✓

2. KSC Support for Special R&DO Tasks: It has become necessary to formalize the operating procedures for obtaining KSC support for special (not specifically Saturn-Apollo oriented) R&DO tasks. Recent reorganizations at the Cape have made a continuation of the buddy system impractical. Meetings with Colonel Montgomery and representatives of the KSC Apollo Program Office have resulted in an understanding of the operating mechanisms which we and they will establish to place requirements on KSC and obtain their responses in support of these special tasks, such as wind profiles, special tracking requirements, etc. ✓

NOTES 5/22/67 GEISSLER

5/22 GB

B 5/25

1. AS-205 Mission: MSC recently contacted MSFC via the Flight Mechanics Panel relative to changes in the AS-205 profile which is presently a 85 x 130 n. mi. elliptic orbit. The changes under consideration are due to incorporation of a "rendezvous exercise" with the S-IVB/IU/SLA which would be planned between the first and fifth day of the mission. This exercise will require a considerable longer L/V orbital lifetime than that obtained on the 85 x 130 n.mi. orbit. To obtain this, MSC is considering the following: The S/C weight would be tailored for a 120 x 150 n.mi. ellipse without requiring use of L/V reserves (3σ). Some consideration has also been given to carrying an ejectable pod as a backup target for the rendezvous exercise in the event an adequate S-IVB/IU lifetime cannot be achieved. We are generating some parametric data on orbital altitudes vs lifetime (on the AS-205 vehicle characteristics) and will have performance capabilities corresponding to the altitude ranges under discussion. This subject will be closely coordinated at MSFC and with MSC (via the Flight Mechanics Panel) before any specific change is recommended. We will keep you informed of results. ✓

2. Voyager Trajectories, Performance, Guidance and Navigation Working Group: Mr. Clyde Baker, Marshall's senior member of this group of the Voyager Mission Design Panel, attended the group's first meeting here on May 11 - 12, with representatives from JPL, LRC, MSFC, and VIPO (Voyager Interim Project Office). The meeting was held in a spirit of cooperation, and an excellent exchange of ideas and technical information took place. Primary topics discussed were a review of trajectory design and accuracy requirements for all phases of the Voyager mission, and the various system's capabilities to meet these requirements. Several of the resulting action items are (responsible agency shown in parenthesis): (1) Review the constraint that Canopus occultation will not occur for 30 days after Mars orbit insertion (MSFC); (2) Review the constraint of no loss of solar acquisition for 30 days after Mars orbit insertion (MSFC); (3) Define regions of interest on the planet, range of latitudes for sub-periapsis, and preferred arrival dates for 1973 (VIPO Science Panel/ Dr. Hale/Dr. Campen); (4) Identify desired photographic lighting angles, subsatellite requirements, and constraints and restrictions for UV spectrometer experiment (action same as #3); (5) Identify range of entry angles required for capsule bus system (LRC); (6) Select a Mars atmospheric model for orbital lifetime analysis (MSFC); (7) Conduct range safety analysis for 45 and 115 degree launch azimuths (MSFC); (8) Establish view period and antenna pointing requirements associated with S/C surveillance of landing site (JPL); (9) Investigate requirement for controlling entry velocity to 100 m/sec (LRC).

We have also sent one staff member (Mr. von Puttkamer) to the west coast to discuss his planned temporary assignment to VIPO, Mission Analysis and Engineering Office, with Mr. Robillard, after a preliminary agreement between Mr. Robillard and myself at the last Voyager project meeting at Pasadena. ✓

NOTES 5-22-67 GRAU

5/22 KS

B 5/25

1. ATM: Honewell Radiation Center, Boston, Massachusetts, quality and reliability personnel made a general presentation of their interpretation of the contractual quality and reliability requirements of the ATM Fine Sun Sensor Contract, and discussed in general what their proposed quality system will be. The outline of their system is good. Honeywell did express some concern about DCASR resident personnel qualifications. Representatives from our Northeastern Regional Office will visit their facilities to discuss the contract requirements with DCASR and Honeywell personnel, evaluate any potential problems in this area, and promote good working relationships. ✓

2. MSC QUALITY AUDIT: Two representatives from this Laboratory participated as team members on the Headquarters (KR) evaluation of MSC. The audit consisted primarily of determining the degree and effectiveness of implementation relative to NHB 5330.7, "Management of Government Quality Assurance Functions for Supplier Operations." Of interest was the high-level management in attendance during the exit inteview; Dr. Gilruth, George Low, all Directorate Chiefs of MSC, Dr. Lorman of Industrial Affairs, and Dr. Condon of KR among others. ✓

3. ESE: The tubelet rework of RCA-110A printed circuit assemblies is now in its third week at RCA/Huntsville. Laboratory personnel who are maintaining surveillance over the local operation report that RCA is properly equipped and staffed to do excellent rework. We are watching this operation closely. ✓

NOTES 5/22/67 HAEUSSERMANN

5/22 KS

B 5/25

1. Optical Communications. In response to your request, a more exhausting investigation has been made to determine the potential of optical communications and arrive at a realistic comparison with microwave systems.

Dr. J. L. Randall contacted the Voyager Project Manager at JPL and arranged to brief him on optical communications and to initiate a discussion of predicted Voyager requirements. About 30 interested personnel attended this briefing. Dr. E. Rechtin was not in attendance.

Dr. Randall has made several attempts to establish amicable relations with Dr. Rechtin to discuss the pros and cons of both systems. Dr. Rechtin has remained aloof. It is obvious that he is vehemently anti-laser systems and will not enter into a technical dialogue with Dr. Randall.

Dr. Mac Adams invited Dr. Randall and Dr. Rechtin to present papers in a NASA briefing for industry on May 3 and 4, 1967, in Cambridge, Massachusetts. Several comments will be of interest to you.

Dr. Rechtin's fundamental argument was that RF systems can provide data rates which are adequate. He projected 6 mega bits/sec from 97×10^6 Km with RF systems in the 1980's with arrays of 210 feet receiver antennas and advanced coding techniques, as yet unproven. While he admitted reluctantly that laser systems may prove in the long run to have an advantage over RF systems for high data rates, he does not believe that they will be required.

Dr. Randall stated that optical communication systems have an advantage for high data rate links from deep space. A description of how such systems work was given. Since Dr. Rechtin admitted that additional gain in RF systems comes only at a very high cost (such as $250 million for an increase of 4 inches receiver area), it is crystal clear that an increase in capability at optical wavelengths is most promising.

We shall continue this program and made every effort to discuss the pros and cons with knowledgeable people.

NOTES 5/22/67 HEIMBURG B 5/25

5/22 XD

S-IC STAGE (MTF) A successful 125 seconds acceptance static firing was conducted on the S-IC-4 stage May 16, 1967. It is expected that the stage will be moved from the test stand on June 1, 1967.

F-1 ENGINE Test FW-062 was successfully conducted on May 19, 1967, for 20 seconds on the F-1 Test Stand to check out engine F-5038-1 which has had numerous component changes. The next test is scheduled for May 22, 1967, to establish a baseline for the lox depletion tests and to evaluate the thrust vector control system with a new servo-actuator filter assembly installed.

MODERATE DEPTH LUNAR DRILL PROJECT A reply to the RFQ to Joy Manufacturing Company was received and is being evaluated. Their total target cost quotation was $210,790.

S-IVB STAGE (MSFC) Test S-IVB-044 was conducted on May 18, 1967, (J-2 Engine 2048) for a duration of 4.7 seconds. The planned duration was 150 seconds, however, a hinged stairway cover broke loose and fell on the chamber level, possibly due to a hard start and the test was terminated. The cause of the hard start is under investigation. Post-test visual inspection revealed no damage to the engine.

S-IB Test SA-47 on stage S-IB-10 is scheduled for May 22, 1967, at approximately 4:45 p.m.

SATURN V SWING ARMS Two weeks ago, KSC management discovered that the lox propellant lines of the Saturn V Service Arms have not been qualification-tested. As a result, Test Lab was requested to conduct proof pressure test, thermal shock test, and water flow test (50 hours) on the lox lines of Arms 1,4, and 6. To accomplish these tests, the flow 3 arms were removed from the GSE test area and moved to the S-IC Static Test Stand (West Area) where the test will be conducted. The target completion date is June 2, 1967. This has disrupted the work on the lanyard modifications.

HOLDDOWN ARMS KSC has started inspection on 501 holddown arms. No word on any cracks reported, so far.

ME Lab is grinding and attempting to repair two of the arms from the test area. We will let you know any developments.

J-2X PROGRAM A pressure-fed J-2 Combustion Chamber, set up at CTL, for work on the J-2 throttleability program was successfully fired on May 18, 1967. The first test was only a transition test and was cut off at 300 p.s.i. chamber pressure. (Approximately 50% pc) The first phase of the program will check performance at varied thrust levels (thrust not varied during run) from 5K to 200K. In the second phase of the program, the thrust will be varied dynamically.

The next test scheduled for May 23, 1967, will be a 15 second test at 300 p.s.i. chamber pressure.

B 5/25

NOTES 5-22-67 HOELZER
5/22 GS

Negative report.

NOTES 5/22/67 JOHNSON

5/22 XS

B 5/25

Nothing of importance to report.

NOTES 5-22-67 KUERS

5/22 KS

B 5/25

Spray Foam Insulation for S-II-8: It appears that we have a number of problems in the development of the spray foam insulation for S-II-8 sidewalls for the LH_2 container. The main problem seems to be that the engineering requirements and specifications are not yet fully established. Strength of bond of foam to skin, strength and properties of foam itself, requirements for uniformity of foam with respect to acceptability to bubbles or small voids, etc. have not been defined for actual flight condition. Consequently it is not known whether present techniques and equipment for application of foam are adequate or not. Also non-destructive inspection methods seem not to be available for quality control. What is needed is either a plan for this development or better a man or group of men at NAA whose responsibility it is to develop this new insulation. I plan to discuss this problem this week with Mr. R. Ruud.

NOTES 5-22-67 LUCAS

B 5/25

5/22 XS

1. FRACTURE TOUGHNESS TESTING PROGRAM FOR S-II: This program is proceeding very well. Material for preparation of the weld test panels for all four phases of the work has been machined by R-ME and shipped to NAA/SD for welding. Additional weld panels of thicker material are being prepared in-house for fracture toughness tests. The major problem at the moment appears to be that of procuring some special instrumentation for strain measurement, and this may be the pacing item for meeting the established schedule. R-ME has been cooperating with us on this program by machining appropriate test specimens. ✓

2. R-P&VE-M COBALT RADIATION SOURCE: We have placed in operation a 24,000 Curie $Cobalt_{60}$ radiation source. Checkout and calibration is due to be completed this week. The gamma flux in the sample chamber is about 10^8 ergs/gm or about the same level as the GD/FW reactor or the NERVA reactor at tank level. ✓

3. FAILURE EFFECTS ANALYSIS (FEA), CRITICALITY ANALYSIS (CD), AND RELIABILITY ANALYSIS MODEL (RAM) FOR SA-501: The final SA-501 FEA, CD, and RAM have been completed and distributed. The data contained in these documents have been reviewed by the appropriate stage contractor and their comments have been incorporated. The data contained in these documents are correct and supersede all previous data for this vehicle. ✓

4. BP-30 PAYLOAD: Refurbishment of the BP-30 (backup) Payload for 501 mission is progressing. The escape tower has been mounted to the command module. Installation of 7,000 lbs. ballast inside the command module will require the design of additional support structure. The propulsion tanks in the service module used for carrying water ballast need support ring reinforcements. Obtaining up-to-date NAA documentation remains the primary problem associated with these modifications. Work arounds and overtime must be used to meet the shipping date. There may be a few shortages at shipment time but, hopefully, these will not be serious. ✓

5. MULTIPLE DOCKING ADAPTER (MDA): We are considering holding a paper design review for the MDA prior to the planned formal PDR and astronaut walk-thru. Such an arrangement is almost mandatory since some items such as the neutral buoyancy article and structural test section will be built and perhaps delivered to MSC prior to a formal MDA walk-thru. Moreover, paperwork should be made available to all concerned parties (MSC, KSC, etc.) at the earliest possible date. ✓

6. THERMAL AND ENVIRONMENTAL CONTROL SYSTEM SUBPANEL: The first meeting of this subpanel of the AAP Mechanical Panel is scheduled to be held at MSC on May 24 and 25, 1967. The thermal interface between MSC-delivered equipment and ATM, MDA and Workshop will be discussed. ✓

NOTES/5/22/67/MAUS 5/22 5/25 B

APOLLO COST STUDY, 1967 - The following data is the current output from this year's study. Although the study (at Headquarters) is not fully completed, we do not anticipate any significant changes in the values. Last year's data is shown for comparison purposes.

	1966 Study		1967 Study	
	Saturn IB	Saturn V	Saturn IB	Saturn V
CSM	44.1	44.1	50.7	50.7
LEM		42.1		46.9
Launch Vehicle	36.8	178.0	37.7	183.8
Launch	10.8	39.0	17.0	40.0
	$91.7 M	303.2 M	$105.4 M	321.4 M

These costs reflect the average unit cost for the basic hardware and launch costs of the follow-on AAP flights. The cost of experiments, modifications, flight mission and recovery operations are not included.

Dr. Mueller's staff is bringing to Dr. Mueller's attention the following points:

a. Engine production support costs appear much too high and are to be investigated by ML (Saturn/Apollo Applications). Current MSFC numbers will be used for budgetary purposes pending the results of this investigation.

b. There exists a wide difference in Saturn IB/Saturn V common item costs (S-IVB, IU, J-2).

c. There exists a wide difference in vehicle support (non-prime contractor) costs for the Saturn IB and Saturn V. Approximately $20 M per year for Saturn IB and $160 M per year for Saturn V.

As you recall, regarding items b and c, we have had these differences in past studies and have explained this many times.

Separate copy: For discussion Staff luncheon 5/29

pdr 5/29 B

B 5/25

NCTES 5/22/67 RICHARD

5/22 RS

No submission this week.

NOTES 5/22/67 RUDOLPH

B 5/25

5/22 DS

1. S-IC-4 Stage at MTF: Captive testing was successfully completed on Tuesday, 16 May 67, with a duration firing of 125 seconds. ✓

DR why not the full 140 sec? B

2. S-II-2 Stage at MTF: Stage departed MTF by barge on Friday, 19 May 67; and is expected to be on-dock, KSC, on Thursday, 25 May 67. ✓

3. S-II Stage Special Electrical Inspections: Detailed inspections were made on the electrical networks on S-II-1 Stage at KSC, S-II-2 Stage at MTF, and S-II-3 Stage at Seal Beach. Numerous "squawks" were listed, most of which are being worked off in parallel with other work; however, a few of the items require engineering changes. ✓

4. S-II Stage Weld Inspections:

o The dye penetrant inspection of the S-II-6 Stage after pneumastat testing revealed a very large number of weld cracks (75 inside and 29 outside cracks). The cracks are now being repaired; however, re-pneumastat testing will be required. As a result of the crack repairs and other problems, stage delivery to KSC will be delayed from 20 February 68 to 8 April 68.

o Dye penetrant inspections (after pneumastat testing) were previously conducted on S-II-2, S-II-4 and S-II-5 and only a small number of flaws were found, which were grooved out. A dye penetrant inspection of the S-II-3 Stage will be made at Seal Beach as soon as practicable; and the necessity of making a dye penetrant inspection of the S-II-1 Stage at KSC is now being reviewed. ✓

5. S-II-7 Stage at Seal Beach: An estimated 7 week delay in shipment of S-II-7 to MTF will be encountered as it is necessary to cut apart and replace 2 quarter panels on LH_2 cyl 3/cyl 4 assembly. Vidigage inspection revealed an under tolerance condition of .029" on the systems tunnel quarter panel of both cylinder 3 and cylinder 4. The thin wall condition resulted from stress relief milling of "canned" areas after weld repairs. Two quarter panels from S-II-8 will be reallocated to S-II-7. ✓

6. Program Managers Pre-Flight Review of SA-501: My review was held on Wednesday, Thursday, and Friday, 17, 18, & 19 May 67, and was well supported by both contractors and R&DO. ✓

7. AS-501 Launch Vehicle at KSC: Spacecraft erection has been delayed an additional 16 days, and is now scheduled for 11 June 67 in lieu of 25 May 67. ✓

NOTES 5/22/67 SPEER

5/22 KS

B 5/25

F.S. I would like to see it B

1. REALIGNMENT OF OPERATIONS SUPPORT REQUIREMENTS OFFICE (OSRO): In spite of the delay in the reorganization of the MSF Mission Operations Office, Gen. Stevenson has published a new charter with strengthened responsibilities and a streamlined organization of OSRO. The realignment will have very little effect on our operating mode with OSRO. ✓

2. AS-501 PROGRAM MANAGER PREFLIGHT REVIEW (PMPFR): We participated in the AS-501 PMPFR on May 17 and presented to Dr. Rudolph all open items in the operations area; none is considered critical for roll out or launch. ✓

NOTES 5-22-67 Stuhlinger

5/22 XS

B 5/25

1. VISIT BY PRINCETON ASTRONOMICAL OBSERVATORY PERSONNEL:

Today Dr. Spitzer, Dr. Danielson and three other members of the Princeton Astronomical Observatory visited MSFC to discuss their proposal for a stellar ATM mission. People from SS, ASTR, EO, ASO, P&VE and Saturn Apollo Applications Office met this morning with the group. We were able to furnish the Princeton people with much-needed information about the solar ATM and the current cluster design which should enable them to better define their design. In turn, we learned much about their proposed stellar telescope, and this information can be used in our future planning. ✓

2. ASTRONOMY SUBCOMMITTEE: I participated in a three-day meeting of the Astronomy Subcommittee, which was temporarily joined by the Solar Physics Subcommittee. A large number of astronomical projects (radio, IR, UV, X-ray, γ-ray) for unmanned, and some for manned flights were discussed. The EMR is now fully accepted by the Subcommittee, and included in the Committee's planning exercises. Progress of the ATM is followed by the two Subcommittees with great interest. Considerable attention is given to MSFC's efforts to solve the problems of thermal design, optical contamination, and film fogging. ✓

NOTES 5/22/67 TEIR

5/22 KS

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AAP PERFORMANCE UPRATING MEETINGS: The series of meetings with DAC and CCSD were concluded May 18. An MSFC in-house meeting was then held to discuss the presentation to be given to Mr. Mathews on May 24. The performance improvements associated with the early nosecap/SLA jettison and the S-IVB kick with solids in the apogee were agreed to. There was a wide difference between DAC and MSFC on the performance which can be gained by S-IVB restart and the presentation to Mr. Mathews will not have hard numbers identified for this item. We are meeting with R-AS and I-S/AA today to develop the package for the Mathews' meeting. ✓

S-IVB-205 REVALIDATION: Reference is made to Mr. Grau's weekly notes of 5/15/67 concerning portions of stage testing being invalidated by numerous hardware changes and the extended storage time. DAC is currently developing a revalidation checkout plan for S-IVB-205. This plan will be submitted to MSFC for approval. Upon the establishment of a firm delivery requirement for this stage, a schedule for this checkout will be firmed up. ✓

INTERIM DELIVERY SCHEDULE: Based on informal telephone conversation from Headquarters, and the tentative Mueller schedule issued for planning purposes, we have issued an interim delivery schedule for all of our remaining stages. This should enable each stage manager to take whatever action is appropriate with respect to revising his contractual instructions and recommend to the Program Manager necessary contractual actions to eliminate overtime. This was considered necessary due to the numerous slippages in the release of Apollo Program Directive 4G. It is expected that the Apollo Program Directive 4G will be released in some two or three weeks. The following are the interim dates we are now planning on:

	moved from	
SA-205	dec. '66	October 31, 1967
SA-206	march 31, '67	February 28, 1968
SA-207	July 15, '67	January 31, 1968
SA-208/209	may 15, '67	May 31, 1968
SA-210/211	Dec 31, '67	August 31, 1968
SA-212	apr 15, '68	November 30, 1968 ✓

Posted in your calendar. BS 5/22

SA-204 ELECTRICAL WIRING AND CORROSION INSPECTION: Completion of the corrosion inspection was delayed slightly because of the effort diverted to performing the electrical wiring inspection. DAC has completed the S-IVB corrosion inspection and we expect the other two contractors, CCSD and IBM, to complete and all to report this week. Corrosion on S-IVB-204 is minor. The S-IB and S-IVB wiring damage was minor but does indicate that we do damage our wiring. DAC announced that, as a result, they are planning to start a monthly wiring inspection. Although "monthly" may not be the right interval, we will work with KSC to initiate similar action with all stages. ✓

NOTES 5/22/67 WILLIAMS

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B5/25

1. Nothing of significance to report.

May 29, 1967

5/20

BALCH 5/29/67 NOTES

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S-IC-4 - Stage is still scheduled to be removed from test stand on 6/1/67 and to be shipped to Michoud not later than the following day. Discrepancies have been noted in the pressure transducer data obtained during the S-IC-4 firing on 5/16/67. Investigation reveals that these discrepancies were caused principally by the setup technique utilized by Boeing. Action has been taken to correct these procedural errors and to further refine the method of presenting the transducer information. ✓

S-IC-5 - Stage is now scheduled to be shipped from Michoud to MTF on 6/5/67 and to be installed in the B-2 position of the S-IC test stand immediately for change-out of Engines 3 and 5 and start of preparations for acceptance testing. S-IC-5 End Item Test Plan has been received and is being reviewed. ✓

S-II-3 - Because of discovery of hairline cracks in S-II-6 LH_2 tank welds, decision was made to perform additional in-tank inspections on the S-II-3 stage at Seal Beach. Because of these additional inspection and the post-manufacturing retest, arrival of the S-II-3 at MTF is expected to be delayed to approximately 7/19/67. ✓

S-II A-1 Test Stand - Integrated test of stand and GSE with simulated stage to ready stand for receipt of S-II-3 stage is now planned for 6/14/67 through 6/16/67. Of 214 open items on the facility still to be worked off by the Corps of Engineers, the only one that would constrain installation of a stage in the stand is the calibration of the load cells on the main and auxiliary derricks. This is expected to be accomplished by mid-June. ✓

S-II A-2 Test Stand - This test stand is being prepared for the acceptance testing of the S-II-4 stage, which is now tentatively scheduled to arrive at MTF on 9/15/67. ✓

MTF Buffer Zone Security - Fixed-price contract for security services in the MTF buffer zone during the period 6/1/67 to 6/30/67 has been negotiated with Hancock County, Mississippi, and forwarded to the county Board of Supervisors for signature. Total contract amount is $50,171.23. ✓

GE Support Contract - Formal negotiations with GE on Fiscal Year 1968 general support services were opened on 5/24/67. ✓

NOTES 5/29/67 BELEW

Belew

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SCIENCE AND TECHNOLOGY ADVISORY COMMITTEE (STAC) REVIEW:

On Saturday, May 27, Dr. Mueller's Science and Technology Advisory Committee met all day at Washington University, St. Louis, Missouri, to review the status of AAP plans and progress. The group is headed by Dr. Townes from MIT. Meeting with the group were Dr. Mueller, Dr. Newell, and Dr. Golovan. Mr. Chuck Mathews presented the AAP overview; we presented the status of the Workshop and ATM; and MSC presented status of the spacecraft modifications and the APP-A and B effort. The presentations went over very well and Dr. Mueller remarked that he is pleased with the progress shown.

AAP WEIGHTS AND PERFORMANCE MEETING AT MSF:

We attended a meeting with Mr. Mathews and MSC on May 24. As a result of this meeting, MSC will plan to carry the consumables for the first part of the cluster mission in the Service Module of the first flight (now that the LM&SS will fly on an earlier flight). Consumables will be off-loaded from the Airlock Module. Also, the prime carrier for consumables for the ATM part of the cluster mission is still the Service Module of the AAP-3 flight although some off-loading to the LM/ATM flight is possible. Mr. Mathews requested that we continue to look at SLA/Nose Cone jettisoning as a performance improvement scheme for the unmanned flights for the first cluster. He is not, however, interested in the solid rocket kick motors (on the S-IVB) as performance improvements for the first cluster. He seems to be more interested in performance improvements which can apply to both manned and unmanned flights. In this regard, he asked that a detailed engineering analysis be completed and firm costs be developed for Saturn IB Minuteman strap-on solids as soon as possible.

I called for this already. Bob 6/2

L.B.

AAP FIVE YEAR PLAN:

A review of the proposed AAP Five Year Plan was held at NASA Headquarters on May 24. We do not know at this time whether or not our recommended changes will be incorporated. Pending notification of acceptance or rejection, we will base mission planning on the Five Year Plan with the MSFC recommended changes. The major recommended changes are: (1) provide for launch vehicle performance improvements, (2) plan for ATM-O (EMR) to be available for flight during first cluster revisit following AAP-4, (3) provide option for the Saturn V launched mission module in early 1971, and (4) the high altitude flights to be changed to synchronous orbit missions.

Please send me a 2- or 3-page description of this Five Year Plan. B

EXPERIMENT MOCKUPS:

We have informed our contacts of the plans to conduct a delta-PDR on the Orbital Workshop this summer, and of our desire to have an engineering mock-up available at that time. It appears that in-house and DOD experiment mock-ups will be available in time. MSC-Apollo Applications Program Office has not received the status of the MSC experiment mock-ups but expects to have this status within a week. We are working on the assumption that both Orbital Workshop and MDA experiments will be required. We will submit a plan for having all experiment mock-ups available after receiving the MSC information.

NOTES 5-29-67 BROWN

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F-1 ENGINE An F-1 Mark 10 turbopump, modified to add six partial vanes between the six full vanes in the LOX and fuel impeller was delivered to the Government this week at Canoga Park, California. The pump will be trucked to MSFC and tested in the F-1 turbopump test stand in the MSFC Test Lab. This configuration turbopump which was built as backup to the current pump, is also capable of operating at a higher thrust level and has been successfully tested on three R&D engines to date, accumulating 54 engine tests for over 7878 total seconds.

J-2 ENGINE An apparently successful duration test of the S-II Battleship was conducted late Friday afternoon. The engines operated for 355 seconds of mainstage, until low level fuel depletion initiated cutoff.

Another meeting on the helium regulator (pneumatic control package) is scheduled with Dr. Rees on June 1. Rocketdyne and R&DO have been conducting separate investigations on regulator diaphragm failures and the meeting is to review their findings and recommendations on whether or not to replace the regulator on several delivered engines.

The facility at AEDC has been shut down for three weeks for maintenance on the steam ejector and installation of additional environmental equipment.

Three engines for S-II-510 were delivered this week.

GENERAL On May 22, 1967, Dr. Debus signed the MSFC/KSC Agreement relative to the Rocketdyne field service support to stage contractors at KSC. The implementation of this agreement previously signed by yourself on May 18, 1967 should adequately close out the open action which has existed on this subject since your letter to Dr. Debus dated February 23, 1967. This office has also initiated action with all stage and program offices to implement similar agreements contractually for all other locations for which MSFC has contract responsibilities. This is in direct response to Dr. Rees' request that Rocketdyne's role at all locations be properly clarified contractually and in general consonance with the presentation given to Dr. Debus on May 5, 1967.

B 5/30

NOTES - 5/29/67 - CONSTAN

5/29 PD

INCENTIVE CONTRACTS

The schedule milestone applicable to S-IB-7 stage was slipped approximately seven days in order to conserve overtime being worked by Chrysler Corporation and the Michoud Quality Control group. This action was taken with the concurrence of Mr. Art Thompson, S-IB Stage Manager, inasmuch as this particular stage will be stored for a period of time. In addition to this action, CCSD has been requested to submit a proposal for the most economical delivery schedule for subsequent stages. ✓

B 5/30

NOTES 5-29-67 FELLOWS

5/29 PM

FY'67 Budget Execution: R&D laboratories were advised of procurement actions that must be cancelled or recoded to FY'68 to reduce the R&DO initiations by $3M for FY' 67. FMO and Purchasing were furnished a revised detailed listing of approved initiations. Cancellations are being processed. IO cannot furnish any additional FY'67 funds. ✓

NOTES 5/29/67 GEISSLER

1. Hypersonic Velocity Reentry Research and Technology Meeting at Ames Research Center: On May 22 and 23 I attended subject meeting which was conducted primarily by members of the previous NASA Research Advisory Committee on Space Vehicle Aerodynamics, which is presently, like other Research Committees, being restructured; the new charter and composition have not yet been established. The presentations were primarily devoted to an analysis of the state of the art for designing an earth reentry body and heat shield for a manned planetary mission with reentry speed of at least 50 k ft/sec. While MSC and NAA people essentially took the position that a satisfactory reentry body can be obtained with the present Apollo shape, using just a somewhat thicker ablation heat shield (present material "Avcoat" or a low density phenolic-nylon, total heat shield weight about 2000#), the Ames people emphasized the uncertainties in predicting actual heat loads to be experienced and extrapolating the performance of charring ablator heat shields to such high speeds. For blunt shapes, radiative heat fluxes substantially higher than present total Apollo heat flux values will be experienced, and major uncertainties still exist in computing these loads. Also, the recent studies revealed the complexity of the physico-chemical processes occurring in a charring ablator which makes extrapolation to heat loads beyond those experienced in ground or flight tests difficult and doubtful (e. g. There is concern about effects of vapors released by pyrolysis in deeper layers upon the char layer). The Ames people favor selection of a new shape which consists of an only slightly blunted cone with a half angle of 35° - 40°, cut off obliquely (to produce zero angle lift) and with an afterbody. Such a shape would have very small radiative heat input and its convective heat would be about the same as the total for the Apollo shape at around 50 k ft/sec, with clearly superior performance at still higher speeds. The major uncertainty for such a shape would be the prediction of transition from laminar to turbulent flow which is not yet sufficiently understood. Another drawback against present Apollo shape consists of course in the need for more general aerodynamic test work. It was agreed that further research on both shapes should be conducted, Langley will probably recommend a continuation of the Fire program (Scout vehicle) to test a biconic shape at about 30 k ft/sec. Ames hopes to develop ground facilities to a point where planetary reentry conditions could be simulated. I wonder whether we should not conduct a study for a large scale high speed reentry test program on the Saturn V, which might be combined with other experiment packages like Odyssey (and possibly Thermo) on one Saturn V vehicle. We have to realize though, that the present feeling is predominantly to rely on more ground test work and analysis and postpone the costlier flight experiments to a later time. It was also stated by MSC people that the 501 reentry test was "badly needed."

E.F. The 3M people in St. Paul have developed a new ablator for Army penetration aids which, they say, is several times better than the Apollo heat shield. Suggest you contact Jim Shepherd to get you more info. B

E.F. Suggest we wait until we understand our MSFC involvement in AAP and Voyages a bit better, and until we know NASA's real FY 68 posture B

NOTES 5-29-67 GRAU

5/29 RS

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1. QUALITY SURVEYS: A recently completed quality survey (NAA) revealed the following areas to be inadequate at SD: Non-Conforming Reporting and Corrective Action, Time/Cycle and Age Control, and Unsatisfactory Condition Reporting. The major recommendation of the survey team was that operation and control of the above areas be consolidated under one organization. Presently, Reliability Engineering and Quality Assurance each have their own systems, and there is no one group which ties the two systems together.

   - A critique of the NAA Los Angeles Division (LAD) quality survey was held on May 18, 1967. Mr. J. Young, Corporate Director of Quality and Reliability Assurance, and Mr. E. N. Ljunggren, Vice President of LAD were in attendance. Since we had met with LAD Q&RA management on a daily basis, only those discrepancies of major significance and those which involved the other two NAA divisions were discussed. Of major significance at LAD was the lack of an effective corrective action program. Areas of concern involving the three NAA divisions (LAD, SD, and Rocketdyne) were: conflicting requirements on drawings, lack of definition on the Inter-Divisional Work Authorizations, lack of a unified approach for the Material Review Board by the three divisions, and several areas of technical conflict between SD and LAD. ✓

2. ROCKETDYNE CRITICAL SUPPLIERS SPECIAL SURVEYS: As of May 24, 1967, Rocketdyne had completed 85 of the 119 special surveys being conducted at critical suppliers. These surveys are the results of materials and processing problems experienced by MSFC contractors. MSFC personnel have participated in 31 of these surveys. Outside of minor individual variances, the only significant finding has been that suppliers do little reverification of material certifications beyond contractual requirements. ✓

3. INCREASED ROCKETDYNE FIELD SUPPORT: Agreement has been reached between MSFC and KSC which paves the way to permanent Rocketdyne quality control at KSC. It was reported that Dr. Debus signed the agreement May 23, 1967. ✓ Actual staffing arrangements for this support are still being negotiated, but implementation is expected soon. Some Rocketdyne quality control people have been provided to KSC on a TDY basis, and they will ultimately be provided on a permanent basis. Separate warehousing is being established at KSC for Rocketdyne engine hardware to control flow of good and defective hardware. This should alleviate some of the logistics and quality control problems experienced in the past. ✓

NOTES 5/29/67 HAEUSSERMANN

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ATM/ASTRONAUT MEETING

A two-day session was held with the ATM Astronauts at MSC to discuss the ATM display and control panels, ATM power and networks and the ATM pointing control system. The significant aspects which came out of this session were:

a. MSC has a strong desire to have all functions from the display and control panels controlled by individual switches as compared to the MSFC approach of a code selection operation, i.e. using the Saturn-developed switch selector.

b. There is somewhat a divided MSC view concerning the extent to which the Astronaut should be utilized, and our impression is that among the Astronauts there exists a difference of opinion. The scientist/astronauts prefer the automated mode whereas the pilot types are more inclined to the manual mode. The MSFC approach has been to utilize the digital computer for the complex functions such as the gravity gradient momentum dump. MSC has requested that we explore the possibility of using the Astronaut to perform these maneuvers, thereby simplifying the complexity of the hardware. ✓

NOTES 5/29/67 HEIMBURG

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S-IB (MTF)

Test SA-47.7 seconds test was successfully conducted on stage S-IB-10 on May 22, 1967. The stage is scheduled for shipment to Michoud on June 8, 1967.

S-IVB (SACTO)

An agreement has been reached between R-TEST, Industrial Operations and Douglas Aircraft to include in the Beta III Test Stand rebuild: (a) additional blast protection, and (b) relocation of certain high cost GSE equipment from the lower umbilical room to the upper umbilical room and the terminal room. The added cost for these changes is estimated at $111,000. The above compromise between available funds, schedule requirements and technical requirements was the best that could be reached. S-IVB stage 209 is presently scheduled for firing on June 14, 1967.

S-IC STAGE (MTF)

The S-IC-4 stage is expected to be removed from the test stand June 1, 1967. The S-IC-5 stage will be installed in the test stand on June 3, 1967.

S-IC STAGE (MSFC)

K.H. that test program is planned w/ SICT? B

The S-IC-T stage is expected to be installed in the test stand on June 1, 1967. The S-IC short LOX tank pressure test was accomplished on May 26, 1967. The tank will be removed from the test stand on May 31, 1967.

S-II STRUCTURAL TEST PROGRAM

The concrete pad for the high pressure bottle was poured May 26, 1967. Shop fabrication of the test assembly is progressing.

SPECIAL TEST PROGRAM (LUT SWING ARMS)

The cryogenic lines on swing arms No. 1, 4 & 6 were cold shocked on May 24, 1967, and May 25, 1967. The water flow test was initiated on May 26, 1967.

MODERATE DEPTH LUNAR DRILL PROJECT

Negotiations were held with Northrop Space Laboratories on the Phase II contract. We seem to be in agreement and the negotiations will be completed by PR-RM. A reply to the RFQ to Westinghouse Defense and Space Center was received and is being evaluated. Their total cost quotation was $415,345 which is approximately twice the available funds. Before negotiations can be initiated with Joy Manufacturing, and audit must be conducted to facilitate PR-RM in their evaluation. This should be completed and negotiations underway within two weeks.

J2-X COMBUSTION CHAMBER TESTING AT T.S. #502

Two 300 psi chamber pressure mainstage tests of 15-second duration were successfully completed on May 23 and 25, 1967. All tests objectives were met. During one test a small hydrogen leak occurred on the outside of a hydrogen cooling tube on the combustion chamber but no damage was done to the test stand. The engine has been repaired. The next test is scheduled for June 1, 1967.

SATURN V DAMPING SYSTEM

Testing of the ML-2 Damping System, including the redundant hoist for ML-1 was completed on May 26. The hardware was removed from the tower on Saturday, May 27, and will be delivered to ME Lab today for refurbishment prior to shipment to KSC. On dock delivery at KSC is scheduled for June 15. Testing went smoothly and the system is considered acceptable for use at LC-39.

NOTES 5-29-67 HOELZER

5/29 RS

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MOCKUP OF LEM ASCENT STAGE: The wooden mockup of the LEM Ascent Stage which P&VE obtained from MSC has been taken to the carpenter shop. After refurbishing, it will be set up in the Computation Laboratory for use in ATM crew station analyses and evaluations. ✓

NOTES 5/29/67 JOHNSON

5/29 9:15

B 5/30

FY 68 SRT Program - During the past several weeks Mr. Miles and members of his office have spent a number of days in Headquarters discussing with individual subprogram managers contents of the FY 68 SRT Program. In the case of OART, this individual, personal attention appears to have paid-off, since we have already received advanced initiation authority at about 50% of the FY 68 plan for OART sponsored work. There will possibly be a problem in the OMSF Program. In addition to the regular review of each task unit description by both the Supporting Development Subprogram managers in OMSF, and the discipline area subprogram managers in OART, the proposed work is being reviewed by the advanced study managers in OMSF. In principle this is good. We are finding that in practice it results in nit-picking of words and format. I have a meeting on June 2 to discuss this with George Trimble and will advise you on the outcome.

Common Bulkhead Cryogenic Test - Mr. Cummings of this office, together with Messrs Davis (COR) of ME, and Furman and Kidd of P&VE attended the Cryogenic Failure Test on the bonded segment common bulkhead at the McDonald-Douglas Facility at Sacramento on May 17. Post test observations revealed that the test was highly successful, both from the standpoint of demonstrating the structural integrity of this bulkhead design and also exhibiting the strength of bonded joints under cryogenic conditions. This work was sponsored as a part of the OMSF Supporting Development Program.

NOTES 5-29-67 KUERS

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B 5/30

1. S-IVB Common Bulkhead Program: Both the S-IV and S-IVB stages use a common bulkhead. These bulkheads are made from fiberglass honeycomb core sandwiched between two welded domes. The initial components were bonded on hard tooling fabricated to the theoretical mold line. A review of the first bulkheads fabricated by this technique disclosed the fact that weld distortion, bonding tolerance, and mismatched components coupled with hard tooling precluded optimum results and reliable fabrication. R-ME and R-P&VE could not define an immediate solution but agreed to develop a backup program for resolution of the bulkhead fabrication problems. Several adhesive joining studies were issued including a contract by R-P&VE-M to develop a structural adhesive system compatible with LH_2. From these studies evolved two concepts for bulkhead fabrication. Both concepts were intended to reduce the fit-up and assembly and the consequent reliability problems.

a. The all-welded segmented bulkhead is made by prefabricating segments of bulkhead (honeycomb plus upper and lower skin) and then joining the segments by simultaneously welding the upper and lower skin sections of adjoining segments. The quality of the welds made this bulkhead unacceptable for test purposes.

b. The bonded segmented bulkhead is made by first bonding the standard honeycomb to the standard welded lower (LOX) dome, by then bonding discrete segments of the upper (LH_2) dome to the honeycomb, and by finally closing out the upper skin with bonded doublers. The fabrication was very successful, proving satisfactory mating of the assembly. By utilizing constant thickness gore segments, the hand fitting requirements were thus eliminated.

A test program was initiated to test the resulting hardware: two flight-hardware bulkheads, one S-IV and one S-IVB bulkhead, were pressure tested and cycled using LH_2 and LN_2 as the test media. Both common bulkheads failed near the attachment to the container side walls at a pressure slightly exceeding the negative design limit. To insure a more valid test of the bonded segmented bulkhead, bonded doublers were added for increased strength in the attachment of the bonded bulkhead to the container side wall. This bulkhead when tested to destruction withstood a differential pressure of 48 PSID and then failed in a classical reverse buckling mode. The bulkhead was considered highly successful withstanding 150% of design ultimate and 200% of design limit loads. It is to be noted that secondary failure (tearing) paths went through doublers and repair areas as if the bulkhead were of uniform thickness metal. ✓

During this program, results have been continuously fed back to the stage manufacturers who have generally adopted the doubler application method tested in this program for flight hardware. The repair methods for the common bulkhead are to all intents and purposes qualified by the test series since there were no debond failures associated with the bulkhead test. A final report will be issued on this project by July 1967. Stage management has been advised of these findings and will receive copies of the report. ✓

2. Warehouse: We have been able to release an Army Warehouse (Building 7223) by relocating components to other buildings. This has reduced storage area used by this laboratory by 11,900 square feet. ✓

NOTES 5-29-67 LUCAS

B 5/30

5/29 NA

1. ORBITAL WORKSHOP FLAMMABILITY TESTS: Three-foot-diameter specimens of the S-IVB cryogenic insulation covered with 5-mil thick aluminum foil were tested in the AEDC hypervelocity impact facility; burning characteristics did not differ appreciably from earlier tests with the 2-mil thick aluminum foil. Considering the additional difficulty in bonding, there seems to be little or no advantage at this time in using the 5-mil material for flame retardation.

2. S-IVB COMMON BULKHEAD: The S-IVB research common bulkhead (forward face adhesively bonded instead of welded) was tested to failure at Sacramento on May 17, 1967. The bulkhead failed in general instability at a reverse pressure of -48 psid. This pressure is 203 percent of the limit design pressure of 23.6 psid. This research program has demonstrated the feasibility of bonded, rather than welded, forward face sheets on common bulkheads. The test also demonstrated that the higher load capabilities associated with the general instability mode of failure can be achieved if the bulkhead-to-tank wall juncture is reinforced locally. A bonded patch on the forward face sheet was also qualified, since a crack caused by the instability failure propagated through the face sheet and patch with no evidence of debonding. This patch technique could be used on the hydrogen side of future S-II and S-IVB stage common bulkheads that need repairs. Based on this test result and the much lower manufacturing costs associated with bonded bulkheads, this method of fabrication appears very desirable for future vehicles.

3. SATURN V CONTINGENCY PAYLOAD - BP-30: All propellant tanks have passed the qualification test. The last tank had a bad weld, causing a leak. It is being repaired. The boost protective cover was fitted and witnessed by KSC and NAA. They recommended that a hole be cut in the SM umbilical plate to provide access to the vent valve. This is being investigated. There appears to be no problem at this time that would preclude shipping on schedule.

4. O_2/H_2 BURNER RESTARTABLE FEASIBILITY TESTS: Multiple restarts of the O_2/H_2 burner have been demonstrated by Douglas Aircraft Company using a new ignitor configuration. Twenty tests have been run. The injector-ignitor tips are holding up very well. Testing will continue until June 1, 1967, then a decision will be made on whether or not to qualify and fly the restartable ignitor configuration.

5. S-IC AFT UMBILICALS: Testing of the aft umbilical/tail service mast (TSM) systems 3-4 and 1-2 with the stiff RJ-1 return line and redesigned lox dome purge line was completed May 19, 1967, at the MSFC test facility. Purpose of the tests was to verify that adequate umbilical retract could be obtained with the stiff lines installed in the TSM's. Adequate umbilical clearance was obtained on all tests.

NOTES 5/29/67 MAUS

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B 5/20

FUNCTIONAL MANAGEMENT REVIEW - Before leaving NASA, Mr. Rieke initiated a study of NASA's functional review process at Mr. Webb's request. Mr. Finger, in his new capacity, has assumed this responsibility and has recently forwarded a draft report to the Center for our review and comment. This report provides an analysis of present review methods and recommends the strengthening of the total review process to serve the needs of Center management, institutional management (OMSF, OSSA, OART) and the Office of the Administrator.

SUPPORT CONTRACTOR DATA - The Henderson Committee (House Manpower SubCommittee of Post Office & Civil Service) hearings to investigate the use of support contractors have been delayed and may not be held during this session of Congress; however, MSF is continuing to collect data to respond to this committee. In addition, to data on support contractors, per se, data collected to date has correlated the number of civil service personnel monitoring the contractor to the contractor effort. At MSFC is has been found that the number of civil service personnel monitoring the support contractors varied from 1 to 2 percent of the manyears expended by the contractors.

HM
Amazingly low! B

TRAINING PROGRAM - Mr. Wible has requested that we conduct a study of the MSFC Training Program to ascertain whether the program is accomplishing its intended purpose and whether it is being directed and controlled in an effective manner. We will be in contact with all MSFC elements involved in training activities and will touch base with other NASA Centers to review their approaches and to exchange information regarding experiences in the training area.

B 5/30

NOTES 5/29/67 RICHARD

5/29 RB

S-IVB Second Burn: (Reference our notes 4/10/67) General O'Connor has been instructed by General Phillips not to implement any hardware changes to S-IVB-V to lower the restart time below 80 minutes. He has apparently left the door open for us to re-negotiate the matter when we can better define the production cost and effect on stage maturity.

L.R. How much change would there be involved anyway? B

We feel we must not let this direction stop our inhouse efforts to correct this situation. If the Apollo program gets "locked-in" on never using the first orbit restart, the Saturn part of the program will really suffer.

Besides substantial losses in reliability and payload, this could bring the MSC injection guidance into play stronger than ever and potentially rob the program of the benefits of our system, which has been designed specifically to do this job and is the better system.

We intend to keep pursuing this item until we can erase any doubts about its implementation.

NOTES 5/29/67 RUDOLPH

5/29 (V) B 5/30

1. SA-501 Launch Vehicle at KSC:

- o At a meeting with Gen Phillips and Dr. Mueller on Tuesday, 23 May 67, it was determined that the SA-501 launch vehicle would be de-erected in order to inspect the LH_2 tank of the S-II-1 stage. The inspection will include:
  - Dye-penetrant inspection of all inside welds possible, including forward bulkhead, but excluding common bulkhead.
  - X-ray of all tank welds possible, including the forward bulkhead, fittings and system plate welds (but no x-ray of common bulkhead).
  - Visual inspections will be made of splice plates, gussets, baffles, foil seals, etc. ✓
- o LOX tank will also be inspected, and will include:
  - Dye penetrant inspection of circumferential, meridian and dollar internal welds of the aft LOX bulkhead.
  - X-ray all aft LOX bulkhead welds.
  - Visual inspection of dynatherm seal, instrumentation, common bulkhead, purge line, baffles, waffle ribs, mast support cables, etc. ✓
- o Maximum effort has been placed on incorporating planned modifications on all stages during the de-stack period.
- o S-IVB & IU stages were de-erected, Saturday, 27 May 67. ✓
- o S-II stage is tentatively scheduled to be de-erected on Friday, 2 June 67, as soon as LOX tank inspection is completed. ✓
- o KSC is developing plans and schedules for accomplishment of all work; and we will advise you of re-erection and roll-out dates as soon as practicable. ✓

2. Orbital Restart of the S-IVB Stage:

- o By teletype, dated Thursday, 25 May 67, Gen Phillips directed that "no Apollo vehicle is to be modified to achieve a restart time shorter than 80 minutes." BuEd

  - This constraint will eliminate first orbit injection opportunities from the Apollo system.

3. Spray Foam Insulation for S-II-8: I have discussed the current status and problems concerning spray foam insulation for S-II-8 with Col Yarchin, Dr. Lucas, Dr. Siebel and Dr. Mrazek. We agreed to work out a plan by which we can insure that the foam insulation problem is resolved. ✓

R.R. I think we should keep pursuing this option, as it would, if available, offer higher payload and higher reliability! B

NOTES 5-29-67 Stuhlinger

B 5/30

5/29/67 B

1. GSFC INTEREST IN ATM-TYPE PAYLOADS: Dr. Ken Hallam, GSFC, spent an extra day after Dr. Spitzer's visit at MSFC and discussed details of his 40" stellar telescope proposal with members of ASO, ASTR, and SSL. Even though he requires a pointing stability of 0.1 arc sec (1/200 millimeter at the end of a 10 meter lever arm), his instrument could probably be gimbal-mounted in a rack as planned for the present ATM, because he will obtain the high accuracy with the internal means of "image shifting". It seems that this experiment could represent a second generation ATM with almost no changes to the present SIV-B-cluster concept. Several other astronomy-type experiments which were brought to our attention recently (large X-ray telescope by AS&E; gamma ray experiments by GSFC; cosmic ray experiments by GSFC) would fall into the same second generation concept. The Princeton Project (Lyman Spitzer), requiring a pointing stability of 0.01 arc sec, will necessitate certain further developments of the present ATM-cluster concept. These three phases of ATM development will lead very naturally into the concept of a large astronomical support facility.

E.S. Like Perkin-Elmers "transfer lens" ? B

2. ATM: PI MEETING: G. Heller, R. Shelton, and I will attend the PI meeting on June 1 in Washington. Shelton will give a presentation on ATM film fogging. It will cover results of the recent radiation exposure tests of ATM films conducted with the Harvard University cyclotron.

What are they? B

NOTES 5/29/67 SPEER

5/29/67

B 5/30

1. VOYAGER MISSION OPERATIONS WORKING GROUP: Reference your question on Notes 5/15/67, Speer (copy attached). The chairman of the Working Group presented a list of specific study tasks to be performed by the group. Most of these tasks really pertained to one system only. Several of the representatives therefore felt the tasks should simply be assigned to the appropriate Center and no group action was required. Additionally, there was some apparent duplication between the working group and the Mission Operations Complex Design Team. The next working group meeting is scheduled for June 6, followed on June 7 by a meeting with Dr. Gates, the Mission Operations System Manager, which I will attend. I expect clarification of these questions in these meetings. ✓

2. AAP FLIGHT OPERATIONS INTERFACE: We met with Mr. Carl Kovitz (Assistant to Kraft) on May 25 and 26 and reviewed the status of the flight operations interface between MSC and MSFC. Mr. Kovitz is now leading the MSC effort in this area. A meeting dealing with more specifics has been scheduled for June 5 at MSC to review the understandings of my April 20 meeting with Kraft and to resolve any differences. At this time MSC will also present their concept of AAP operations. I-S/AA has and will continue to participate in these meetings. ✓

F.S. I'm quite curious about their concept B

3. OPERATIONS RETREAT MEETING: The MSF Operations Retreat meeting originally scheduled for the week-end of April 27 has been rescheduled for the week-end of June 9 in New Orleans. At the request of Gen. Stevenson we have again arranged for the group to tour MICH and MTF on June 10. ✓

NOTES 5/29/67 TEIR

B 5/30

5/29 RD

SATURN IB PAYLOAD UPRATING: On May 24, we, together with AAP and R&DO representatives, briefed Mr. Mathews on methods of uprating Saturn IB payload capability. We obtained approval in proceeding with detailed design analyses for incorporation of four Minuteman strap-ons on the S-IB stage. We are expecting a TWX this week requesting an additional comprehensive presentation in about a month prior to completion of the detailed analyses. CCSD has been alerted and we plan to implement contractual action this week. We have asked R-TO to insure necessary R&DO technical support. Mr. Mathews was also favorable to the SLA/nose-cap jettison scheme for performance improvement on AAP unmanned flights. He did not express interest in the solid motors on the S-IVB stage and indicated that if any further effort is expended, it should be on a low-level basis. We are following up on these actions with R-TO. ✓

RCA 110A PC BOARD REWORK PROGRAM: Last week we completed negotiations with RCA for completion of the computer PC board rework program. We were successful in negotiating the proposed cost of $906,641 down to $520,000. Incidentally, Mr. J. Berkebile and Mr. H. Ricketts, both of the Quality and Reliability Laboratory, have nominations to the Civil Service Commission's "Role of Economy Champions" in Washington for approval in connection with their contributions to the rework program. ✓ Mr. Berkebile suggested the use of tubelets to repair the cracked solder joints. Mr. Ricketts suggested the method for removal of the conformal coating by using a teflon tip mounted in an electric powered mechanical eraser. The savings made by successful repair of the PC boards is estimated to be in excess of $950,000. ✓

STATIC TEST TOWER PROTECTION AND SAFETY: R-TEST has concluded that no additional blast protection is necessary at the S-IB static test tower. They did suggest that a water deluge be added on an umbilical plate near the top of the stage and that a cable tray be removed or an emergency water deluge be added on the tray if the tray cannot be removed. We are expecting recommendations for providing rapid exits at the Beta test stands within the next two weeks. ✓

→ in HSV ?

B

Saco ?

ELIMINATION OF S-IB STAGE PRODUCTION OVERTIME: We are continuing to press for reduction of overtime to the minimum. Last week we requested a proposal from CCSD for the elimination of production overtime on all stages. We also slipped the available-to-ship date for S-IB-7 seven days from the scheduled June 1 date to eliminate overtime. ✓

NOTES 5/29/67 WILLIAMS

B 5/30

5/29/67

1. Five-year AAP Plan:

ASO has been supporting I-S/AA in their work on the subject plan and was invited to participate in the Headquarters AAP meeting of 5/24/67. (Therefore, this may duplicate, to some degree, Belew's notes.) Two items of significance from the meeting were:

a. Although we recommended that the synchronous orbit workshop missions be reduced from two to one, MSF rejected the proposal and left two flights on the "Plan".

F.W.

b. The most significant item of interest during the MSF discussion was the hesitancy by the AAP people to include EOSS in the AAP budgeting. Apparently there is some undercurrent at NASA Headquarters associated with this project and whether or not it should be tied to a planetary or long-duration earth orbital project. Both MSC and MSFC strongly recommended that EOSS be a part of the AAP program. MSF reluctantly agreed to add it in, but there may be a change in that position when it goes up the line.

I think the trouble (or lack of support) comes from OSSA. Will be glad to tell you more about what I heard about this

B

With regards to a. above, as of this date, we have not been able to develop what we consider a "hard" mission for the workshop in synchronous orbit - much less two of them.